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JAPAN AS SEEN BY A FOREIGNER

HENRY LUDMER,
University of Toledo,
Toledo, Ohio

Recently Senator McCarran, Democrat of Nevada, stated among other things "If communism takes China completely, communism will take all Asia. If Japan is denied access to the markets and food supplies of China, this nation will be forced to give up its position in Japan, not for military reasons, but because we can neither feed 85,000,000 Japanese nor provide a market for Japanese industrial production. In that event the Japanese people will accept communism rather than starve. And the next Communist advance will be into the Philippines. If we continue to sit idly by while these events take place, we shall have forfeited our world leadership for peace and democracy. All our gigantic efforts to rehabilitate Western Europe as a bulwark against communism will have been largely to no avail."[1]

This warning illustrates the importance of the area I am about to survey. Although I served in the Pacific Military Intelligence Research Section, U. S. Army, in 1945 and wrote "Japan's Financial authorities," published in the Bulletin of the National Tax Association, volume XXXI, in March, 1946, and "Japan's Tax Structure," published by the International Fiscal Association, Amsterdam, in July, 1947, it does not make me an expert on the subject. Therefore I am using such a cautious title. But I shall try to add a few facts to clarify the main problems we are confronted with in Japan: 1. The geographic problem is how to make use of the strategic advantages of Japan without increasing her military potential; 2. The political problem is how to stop communism without encouraging the growth of authoritarianism in any form; 3. The economic problem is how to attain economic and financial stability in the long run; 4. The main social problem is the annual population increase of two million Japanese without any increase in resources (land, capital, etc.) to take care of them resulting in a tremendous crime wave, etc.; 5. The main military problem is how to provide Japan with self-defense against both internal and external foes without nursing a viper, endangering S. China and the Philippines.

All these major problems, of course, are interrelated and there are many minor problems.

1. THE GEOGRAPHIC SITUATION

Japan is that long crescent-shaped group of four large islands (Kyūshū, Shikokū, Honshū, Hokkaido) and numerous small islands which lie off the Eastern coast of Asia between 30 and 46 degrees north latitude, 130 and 146 degrees east latitude. Somewhat south of the north temperate zone, it is an excellent location for the development of human energies, intensive agriculture and hydroelectric

[1] *New York Times*, April 17, 1949, p. 34.

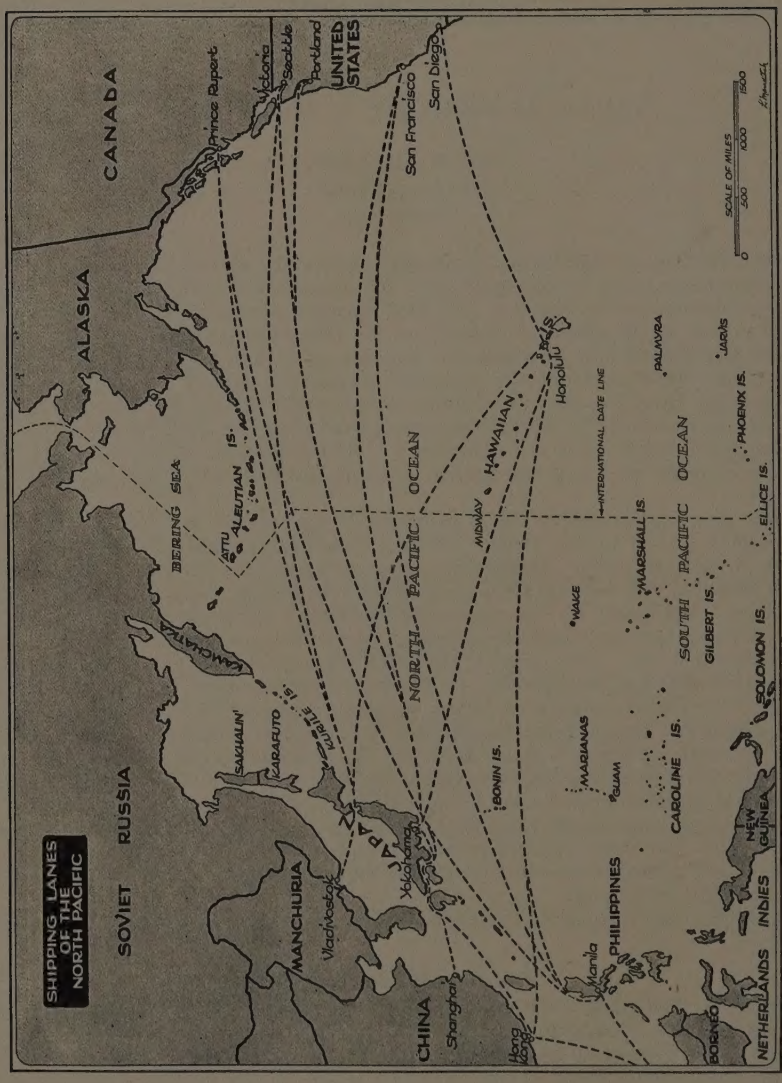

Fig. 1. North Pacific shipping lanes.

power. After World War II Japan lost Korea, Karafuto, Manchuria, etc. Now the total land area is 145,000 square miles—about 3½ times that of Ohio. But Japan's population of 85 million inhabitants is more than 12 times that of Ohio. This overpopulation is a major source of troubles. In addition, about 85% of the total area is mountainous (see figure 2). Many peaks, including the famous Fuji, are volcanic and several are active. Volcanoes contributed to the formation of deposits of sulphur and abrasives, but also caused losses of life and property. Volcanoes, earthquakes, typhoons, and frequent thunderstorms have exercised a profound effect on the Japanese character. The people—nervously energetic, often cruel, subjected to hysterical acts of violence, and possessed of a deeply rooted admiration for the man who has the courage to take life, his own or another's—have the profound sense of insecurity that comes from the fact that the earth shakes under their feet and the mountains rain ashes and hot rocks. This has helped to make them a very cohesive folk, leaning strongly upon one another, more effective in group action than singly—hence more sensitive to group opinion and receptive to authority. To the Japanese the personification of authority is the Emperor (see figure 4), on whom they bestowed divine attributes in the hope or belief that he could give them, his loyal and valuable subjects, some security against unpredictable forces of nature that are themselves the ancient gods of the Japanese and the ancestors of the royal house.

Probably Japan's greatest single natural resource is the position of the islands between the principal Asiatic ports and those of North America, and the further peculiarity of the conformation of those islands that places the best harbors on their Pacific coast and gives that coast the most favorable soil and climate. Hence this area already had a great concentration of population and a considerable development of both commerce and industry long before the opening of the north Pacific trade route brought the world's ships just offshore.

Japan dominates the sea lanes to northern Asia. The whole of the Sea of Japan is truly a Japanese lake. The Sea of Okhotsk, immediately north of the Sea of Japan and extending above the 68th parallel, likewise became a Japanese lake.

The radical curtailment of Japan's naval and air power did not nullify their effectiveness as controls on world trade as long as she has a large industrial population capable of supplying goods and services to the world market. Japan will tend to dominate the commerce of the east coast of Asia.

Tokyo, Yokohama, Nagoya, Osaka, and Kobe, Japan's five principal port cities, are on the far side of the main island and therefore much more accessible to the world's shipping than would be any of the ports on the continent, and it is easily seen that Japan is in a position to cut off or dominate most of our east coast trade even though shorn of her naval and air power.

Strategically the Japanese islands can be considered as one land traversed by two convenient channels for ship traffic, a narrow, very mountainous land bent almost at right angles at 35 degrees north latitude near Tokyo Bay. Japan is a land of good harbors. Her 17,000 miles of coast line are a continuing succession of coves, bays, and estuaries. Thus the greater share of her domestic commerce can be cheaply transported by water. There are a number of excellent deep-water harbors on the Pacific side, particularly on the lower east-to-west extension of Honshu. Yokohama and Tokyo on Tokyo Bay, Nagoya on Atsuta Bay, and Kobe and Osaka on Osaka Bay become natural ports of call for all ships plying the north Pacific shipping lanes (Fig. 1).

Then, too, Shikokū Island, the fourth in size, fits snugly in between Kyūshū and the southward-jutting Wakayama peninsula of Honshū. Between Shikokū and the westerly extension of Honshū is the narrow island-studded Inland Sea that begins at Osaka Bay and extends westward 300 miles to Shimonoseki Straits. There are only three entrances to this all-important waterway and they all are exceedingly narrow, treacherous, and easily defended.

Japan's shipping and fishing industries developed in its protected waters in primitive times. It was a safe avenue for the interisland commerce that must have played an important part in unifying the nation before the beginning of written history. After the establishment of transpacific commerce in the second half of the last century it became even more important because it gave Japan a landlocked passage from Kobe, her greatest shipping port, and Osaka, her greatest industrial city, to the Yellow Sea and the Sea of Japan and the closest route to all the ports of north China, Manchuria, and southern Korea.

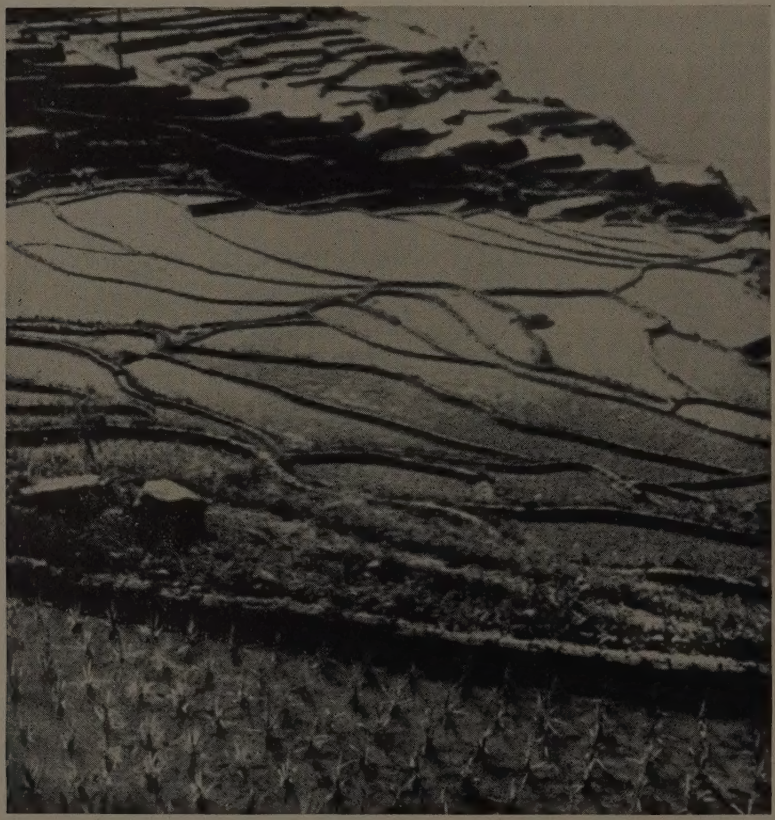

FIG. 2. All suitable land is being utilized by the Japanese.

The amount and comparative certainty of the rainfall during the growing season, together with the natural water storage in the heavy snow on the still well-timbered mountains, makes possible an enormous production of rice in tiny flooded fields (Fig. 2). Japan's food production has been almost sufficient for her own needs, and until recently, it furnished a surplus for export, despite the fact that only about 12 per cent of her total land area can be cultivated (Fig. 3).

Her situation gives Japan her exceedingly important fishing industry. The seas all around her are exceptionally prolific in marine organisms. Offshore

fishing was developed early to supply her population with proteins that could not be raised on her restricted agricultural acreage. When Japan became industrialized she already had a large number of experienced fishermen who readily adapted themselves to the use of motorized equipment and began harvesting the entire Pacific from the Arctic to the Antarctic as efficiently as a farmer harvests a field of wheat. They not only kept Japan's rapidly growing industrial population supplied with the seafood that is such an essential part of its diet but furnished a large exportable surplus that has been an important factor in the country's expanding foreign commerce.

It is important to emphasize that Japan's commercial potential has two obvious factors: 1. production and 2. the utilization of the Asia-North America trade routes. The removal of restrictions that hamper trade over these routes will mean that their use will be vastly increased. The Japanese ports will never

FIG. 3. Intensive agriculture is the main occupation in Japan.

remain mere way stations on these routes as long as Japan has 85 million highly productive inhabitants. That production must be reoriented to fit into a new pattern of world trade based on amity and a free flow of goods rather than one of uneconomic self-sufficiency, the accumulation of military supplies, and the capacity to produce armaments is obvious.

2. THE POLITICAL SITUATION

The primitive basis of Japanese government is the family council. An early unity of all local groups was achieved by the "King of kings," Mikado Jimmu Tenno (550 B. C.) whose picture is very common (Fig. 4). The royal family is in power so long that by the beginning of written history it was already reputed to have had a divine origin. Political unity was the only advantage of the Japanese in their long war to dispossess the larger, stronger Ainus. The political history of Japan may be divided in six periods:

1. 555–1005—Japan under the rule of court nobles, naturalizing Chinese culture.

2. 1085–1550—The feudal period of Samurais and provincial nobles.
3. 1554–1624—The Christian interlude.
4. 1603–1868—The Tokugawa era of bureaucratic autocracy.
5. 1868–1945—The Meiji period and modernization of Japan. Copying of alien civilization. Persistent, purposeful and ruthless expansion.
6. 1945– —Occupation period.

Throughout this history democracy never existed in Japan and it is difficult to transplant it there now. General MacArthur and his staff are doing their best. On March 31, 1949, was the 95th anniversary of our "Open Door" policy established by Commodore Perry in 1854. It went by unnoticed. The Japanese greatly admired Commodore Perry secretly (although he ruthlessly frustrated their designs) but sometimes openly disparaged the sentimental collaborationists and appeasers who conducted American affairs in Japan during subsequent periods. On April 14, 1949, Premier Shigeru Yoshida refused to commit himself before Parliament on whether Japan would remain neutral in the event of a third world war. He did so after a heated interchange with Communist deputy Sanzo Nozaka pressing for "permanent neutrality."[2] The present constitution outlaws wars, but seems to be highly unrealistic in view of the ancient military tradition and present conditions there. A firm and just administration of Japan by SCAP is absolutely necessary.

Prof. Carl S. Shoup of Columbia University will arrive in Tokyo in late May or June, 1949, for a four-month study[3] to revise the Japanese internal revenue system.

3. The Social Situation

The patriarchic social order of Japan was not changed by SCAP too much. But a great amount of social legislation was passed in the last few years (Labor Standards Act, Seamen's Law, Workmen's Compensation Insurance Law, Unemployment Compensation Laws, Employment Security Law, etc.).

Shortly after the occupation of Japan by the U. S. Army, the Supreme Commander for the Allied Powers (SCAP) announced that occupation policy would encourage the growth of trade unions as one means of developing a peaceful and democratic Japan. Confirmed by the Far Eastern Commission in December, 1946, this policy was later included in the Japanese constitution, and embodied in a number of laws. The National Public Service Law gave all wage and salaried workers employed by the Government the right to organize and engage in collective bargaining, and a number of contracts were concluded between government workers and the administrators of government departments and industries run by the government. The law did not deny Government employees the right to strike, but SCAP had full authority to forbid strikes which might endanger the objectives of the occupation.

Nearly 40 per cent of organized Japanese labor is employed by the Government; at the end of July, 1948, 2,500,000 out of Japan's 6,700,000 organized workers were members of Government unions. In contrast with conditions in the United States, about three-fourths of these Government employees were engaged in industrial or other activities not usually considered as part of central Government administration; nearly 850,000 were railroad workers, nearly 350,000 worked in communications, more than 500,000 were in the educational system. In addition, Government workers were employed in coal mines, in the merchant marine, and in the tobacco, camphor and salt monopolies.

The spring and summer of 1948 were marked by a series of strikes over wage disputes in the railroad and communications systems (radio, telephone and tele-

[2] *Toledo Blade*, April 15, 1949.
[3] *New York Times*, April 17, 1949.

graph) which aroused fears as to possible future interference with public services essential to the Government and the occupation. At that time the union of communications workers was Communist-dominated; there was Communist influence in the railroad union but anti-Communists had gained control.

In July, after receiving a letter from SCAP, in regard to the trade-union activities of public service employees, the Japanese Cabinet issued Order No. 201. This Order outlawed acts of dispute by public service workers; revoked the right to collective bargaining; abrogated existing collective bargaining agreements; and

FIG. 4. Mikado Jimmu Tenno, God-Emperor, center of all Japanese philosophy and life.

threatened with jail and fines anyone violating the terms of the ordinance. The labor unions claimed that these restrictive measures violated the trade-union principles laid down by the Far Eastern Commission; SCAP stated that these principles did not apply to Government workers.

Under laws consequently enacted in December, 1948, all public service workers were to be subject to the revised National Public Service Law until April 1, 1949, except that provincial public workers, i.e., employees of prefectural and municipal governments were to remain under the jurisdiction of Cabinet Order No. 201 until other legislation is passed. However, on April 1, 1949, a new Public Corporations

Labor Relations Law started to govern the labor relations of employees of the public monopolies—tobacco, salt, crude camphor, and camphor oil—and of the railroads. Communication workers are among the Government employees who remain under the amended National Public Service Law. The revisions of the National Public Service Law caused considerable unrest among Japanese labor groups as well as considerable criticism in the United States. Differences of opinion as to the new policy regarding government employees resulted in the resignation of James Killen, the U. S. Labor Advisor to SCAP. Both the AFL and the CIO conventions passed resolutions censuring the actions taken in Japan.[4]

Union membership in Japan increased slowly during 1947 and 1948 compared with the very rapid growth in earlier phases of the occupation. According to the September "Summation" issued by SCAP, labor unions numbered 23,270 with a membership of 5,724,851. The Japanese Labor Ministry reported 25,896 unions with a membership of 5,926,986, and added the following figures for some major industrial groupings:

	Unions	*Members*
Mining and manufacturing	12,792	2,702,144
Governmental and "free occupations"	5,187	1,013,479
Transportation	3,635	1,203,196

There are 4,273 collective agreements covering 8,585 unions with a membership of 5,053,297.

Communism has made gains in Japan in the last year and a half in coal mining and electrical workers' unions.[5]

Japan is highly overpopulated which causes social unrest. The comparison between Japan and France on Chart 2 illustrates the gravity of the situation. The overpopulation is also responsible for the present crime wave. The Legal Affairs Committee on the Diet's House of Representatives reported on April 5, 1949, "Last year juvenile crimes amounted to roughly 250,000 out of a total of 520,000 recorded criminal offenses. On the basis of the 1948 informal census, one boy or girl out of every 100 is a convicted delinquent. . . . These youths should be given honest work to do and instead of building more homes and asylums we should build factories and workshops where these boys and girls can work."[6]

Such endeavor should be encouraged by SCAP. The Japanese need work, land, and markets for the ever increasing population, if we are to prevent social unrest. The best way to stop Communism is to make Democracy work.

4. The Economic Situation

The Japanese economy consists of 50.3% agriculture and fishing, 19.7% mining and manufacturing, 20.2% commerce, 7% public services and occupations, and 2.8% domestic work.[7]

Agriculture still is Japan's most important industry both in capital invested and in net output. There is an enormous burden of taxation on farmers. They are greatly in debt. Most of the subsidies granted favored industries are paid by agriculture. There is a decline in soil fertility and increasing use of expensive chemical fertilizers. The silkworm raising and charcoal burning are deteriorating.

Half of Japan's 16,000,000 arable acres are used for rice plantation. Second in importance is barley. Other agricultural commodities raised by Japan are wheat, rye, tobacco, tea, soybeans, fruits, pyrethrum, peppermint, camphor, and garden vegetables.

The most important animal industries are sericulture, coast and deep-sea fishing, and lifestock production.

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[4] *Labor Abroad*, February, 1949, No. 10, p. 64.

[5] *New York Times*, April 10, 1949.

[6] *New York Times*, April 17, 1949, p. 32.

[7] Japan's Wirtchaft im Spiegel der Statistik, Dr. Georg Zimmermann, Berlin, 1941, p. 216.

Japan mines coal, copper, gold, iron pyrites, petroleum, silver, zinc, sulphur, lead, aluminum, manganese, and magnesium. It is important to us because Russia cut off her supply of manganese to us in retaliation to the North Atlantic Pact.

Japanese commerce would need a merchant marine of 1 million tons to handle the normal peacetime inter-island and coastal traffic, and 2½ million tons to transport goods to and from the adjacent coast of Asia. This traffic is absolutely vital to her industry. Japan would also need an internal air transportation system to supplement the 15,000 miles of railroad tracks, canals, and motor transportation. Because of World War II, Japan's foreign trade is way below the pre-war average of 3.6% of the world's foreign commerce. Japan has to have foreign markets in order to feed her growing population.

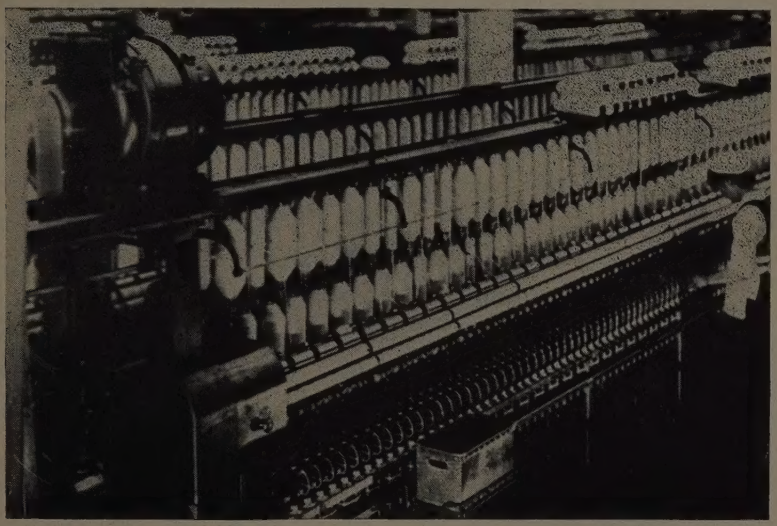

FIG. 5. The most modern textile machines in Japan.

With regard to Japanese manufacturing, the textile industry occupies first place (Fig. 5). Output of textiles is valued at one-third of Japan's total output. The heavy industries, largely the result of Japan's urge for industrial self-sufficiency in the production of arms, is largely uneconomic. It had to be heavily subsidized. Japan produces industrial machinery, engines and motors, prime movers, marine engines, Diesel engines, electric motors and generators, machine tools, railroad equipment, airplanes, automobiles and bicycles.[8]

The chemical industry is of increasing importance, especially the production of synthetic petroleum, dyestuffs, cosmetics, drugs, glass, glassware, and rubber goods. Chart No. 3 shows the organization of the methanol production in Japan.

The production of foodstuffs, clay products and wood products is steadily increasing. Japan is self-sufficient in cement production. The production of newspapers, periodicals and books is relatively more important in Japan than in the U. S. The motion picture industry emphasizes traditional tales. Table I indicates the trends in production from 1930 to 1948.

[8]Japan: Its Resources and Industries, Clayton D. Carus and C. L. McNichols, Harper & Bros., 1944, pp. 231–232.

Industries which increase the military potential of Japan should be curtailed. Reconstruction of such industries, destroyed or damaged in World War II, may again backfire. The key to the maintenance of Japan is production. The primary responsibility for bringing about the required sharp increase in production must of necessity rest with the people of Japan. No action by the United States of itself could bring this about.

TABLE I

KEY PRODUCTION TRENDS IN JAPAN, 1930–1948
(Monthly averages)

Item	1930–34 Average	Peak	1945	1947	1948 First Quarter	1948 as % of 1930–34	1948 as % of Peak Year
Coal (1,000 metric tons)	2,597	4,777 ('40)	4,111	2,270	2,825	108	59
Pig Iron (1,000 metric tons)	104	353 ('41)	42	30	39	37	11
Crude steel (1,000 metric tons)	227	652 ('43)	89	78	97	43	14
Raw silk (bales of 132 lbs.)	59,840	62,838 ('34)	7,768	9,292	8,572	14	13
Cotton yarn (1,000 lbs.)	96,497	132,207 ('37)	4,933	22,434	21,803	21	16
Rayon yarn & staple (1,000 lbs.)	6,888	44,986 ('39)	2,293	2,967	3,891	56	8
Ammonium sulphate (metric tons)	34,733	103,500 ('41)	20,250	60,082	58,103	167	56
Electric power* (millions of kwh.)	1,308	2,857 ('44)	2,715	2,468	2,299	175	80
Cement (1,000 metric tons)	308	500 ('40)	98	103	107	34	21
Crude oil (kiloliters)	21,645	32,049 ('37)	19,947	16,821	15,193	70	47

*Data for 1930–44 represent output of all utilities, while later data represent 95% of all public utility generation.

SOURCE: "Japanese Economic Statistics," Bulletin No. 20, April, 1948, Research and Statistics Division, SCAP-GHQ, Tokyo.

Economic cooperation of America is needed to accomplish two things:

1. Help in the rebuilding and development necessary to reknit the economic fabric of Japan and to increase the level of production so that further relief will not be needed.

2. Relief and financial aid to tide Japan over its present distress and allow it time to accomplish the necessary expansion of production.

The destruction of Japan's industries is the most obvious of Japan's misfortunes. Not all of the destruction was done by bombs; the worst damage was done by the Japanese to themselves under the pressure of blockade. By 1944, Japan was desperately short of three things it couldn't do without—oil, bauxite, and iron ore. The worst case was oil, the shortage of ore was nearly as serious. By 1944 the much publicized stockpiles of steel scrap (the Japanese had accumulated about 250,000,000 tons by 1941)[9] had been nearly exhausted. The government launched a frenzied scrap drive. The greatest victim of the drive was the cotton-textile industry. Of 13,000,000 spindles before the war, only about 2,800,000 were operable at Japan's surrender. Japan had 450 full-fashioned-

[9] "Japan's Road Back," *Fortune*, Vol. XXXIII, No. 3, March, 1946, p. 125.

hosiery machines; all but 50 were broken up, though each machine cost about $15,000 and yielded only 15 tons of scrap, worth about $250.[10]

5. The Financial Situation

Money, at the end of the war, was plentiful. Notes outstanding of the Bank of Japan increased from 5.9 billion Yen at the end of 1941 to 42.3 billion Yen at the end of August, 1945, and were approaching 56 billion Yen at the end of 1945. Prices were held stable in a white market by price fixing and rationing while bushels of surplus money went shopping in the black market. By Bank of Japan estimate, the black market price of rice in October, 1945, was 47 times the official price; vegetable prices were nearly 10 times; sugar, sauce, and salt were 52 times.[11]

A huge excess of money and liquid claims over salable assets is commonplace in the financial wreckage left by the war. Prodded by General MacArthur's headquarters, the Japanese Government pared down some of the excess liquidity with a walloping capital levy running up to 70%. In addition, a 100% tax was applied to all war profits earned since Japan went to war.[12]

Another big financial operation accomplished for the Japanese economy was the excision of the Zaibatsu, the handful of huge family trusts that owned or controlled a good two-thirds of everything in Japan (Mitsui, Mitsubishi, Sumitomo, Yasuda, Iwasaki).

The Government was also ordered to stop all financial assistance to the cult of State Shintoism, which every Japanese previously had to embrace in addition to his personal religious beliefs. It also has to balance its annual budget.

Japan has lost as a result of the war 47% of her former territory while the population, within the reduced area, has witnessed an increase of 13 million since the surrender. Industrial production has declined 77%. Even in total production, there has occurred a decrease of 40%.[13] It is impossible, under such circumstances, to stabilize the Japanese economy without the aid of foreign capital. In spite of the strenuous effort for economic recovery, industrial production lags behind expectation because of uncertainties of the future, instable exchange rates ($1 = 14–320 yen), lack of capital and the unknown burden of reparations.

The Board of Directors of the Export-Import Bank of Japan on April 21, 1948, authorized participation to the extent of 29 million dollars by the Bank with a group of commercial banks in a $60 million revolving credit in favor of the Occupied Japan Export-Import Revolving Fund to finance purchase and exportation to Japan of U. S. cotton, including cotton linters and waste. This Fund was established by SCAP for the purpose of providing a credit base and a means for financing primarily on a self-liquidating basis, Japanese imports and exports of commodities and services required for the achievement of the objectives and policies of our Occupation. Accordingly, SCAP transferred to the Fund approximately $104,000,000 worth of gold, silver valued at $18,000,000, and cash $378,000. Thereby we are subsidizing Japan's foreign trade. This help, though great, is not adequate to achieve financial stability and to sustain 85,000,000 Japanese in their poorly-endowed islands.

6. The Military Situation

On August 14, 1945, General MacArthur was designated Supreme Commander by the nine nations at war with Japan (Australia, Canada, China, France, Netherlands, New Zealand, U. S. S. R., U. K., and U. S.) and accepted the unconditional surrender of Japan. Occupation forces which first went ashore were U. S. troops

[10] *Ibid.*

[11] "Japan's Road Back," *Fortune*, Vol. XXXIII, No. 3, March, 1946, p. 128.

[12] "The U. S. Does a Job," *Fortune*, Vol. XXXV, No. 3, March, 1947, p. 134.

[13] "The Birth of the New Japan," *Education*, Nov., 1948, p. 171.

and the policy directives under which General MacArthur began enforcing Japanese fulfillment of the surrender terms were issued by the U. S. Government on August 29, 1945. The policy document was the product of a coordination of efforts among the State, War, and Navy Departments recognizing that in the postwar period U. S. foreign policy and U. S. military policy must function as one, as national policy.

In Tokyo, SCAP works closely with the Allied Council for Japan (ACJ) which is composed of SCAP or his deputy as chairman and U. S. member, one representative from the Soviet Union, one from China, and one representing jointly Great Britain, Australia, New Zealand and India. To carry out the job of occupation, SCAP has a carefully planned and specially staffed organization composed of staff sections controlling virtually every phase of life in Japan. SCAP closed 159 institutions with assets of 209 billion yen. Liquidation proceeds have been 8.8 billion yen and payments of domestic claims 7.4 billion yen.[14] SCAP is demilitarizing Japan. The Japanese people seem united in opposing war. Their determination is based not only on the formal pledge to renounce the right to belligerancy as set forth in the new constitution, but on their hatred and disillusionment with regard to the past militarism.

Strong opposition is being voiced by China and the Philippines to the U. S. plan to assist and promote Japan's recovery. It is based on the apprehension that an economically strong Japan would again prove to be a menace to them. But General MacArthur never envisaged any plan for American assistance to Japan at the expense of China or other Asiatic countries. The recent change in American policy toward Japan in assisting her recovery has given new hope to the Japanese people. But real recovery for Japan waits upon the formulation of a comprehensive and coordinated program for the revival of all Far Eastern countries along the lines which the United States has been pursuing in Europe, i.e., a PACIFIC SECURITY PACT, tieing together all countries opposed to aggression from Alaska to New Zealand.

[14] "Two Years of Occupation," SCAP HGQ, August, 1947, p. 10.

A CLIMATIC STUDY: LEXINGTON, KENTUCKY

HARRY K. HUTTER,
University of Toledo,
Toledo, Ohio

Lexington, administrative center of Fayette County, is located 80 miles south of Cincinnati, 75 miles southeast of Louisville and 55 miles northeast of the geographic center of the state. It is situated in the heart of the Bluegrass region and lies at an elevation of approximately 1,000 feet above sea level. The surface of the county is mildly karst and gently rolling with a maximum relief of 200 feet. Eastward the relief becomes more pronounced and at a distance of 50 miles the westward-facing edge of the Cumberland Plateau is reached.

The Bluegrass region was one of several sections west of the Appalachians settled and developed at an early date. The first settlers came mainly by way of the Wilderness Trail which ran through the Cumberland Gap. Interest was directed not only to the excellent forests, fertile soils, and choice crop lands, but to the region's climate as well. Some of the climatic records for Lexington date back to 1828. The early records, however, were fragmentary and were not continuous.

Professor Thomas J. Mathews of Transylvania University, Lexington, Kentucky, kept the records during the year of 1828 and part of 1829. In the years 1835–1838, Dr. L. P. Gandell and Dr. Robert Peter, both of Transylvania University, made observations of temperature, rainfall, and barometric pressure. A report was made to the College of Physicians and Surgeons and an article appeared in the *Transylvania Journal of Medicine*, entitled "Notices of the Weather and Diseases of 1835." No further records are available until the year of 1858 and from that date to the present, records are complete with the exception of the years 1876–1879 inclusive. Beginning with the year 1858 records were kept by Mr. H. F. Hillenmeyer of the Hillenmeyer Nurseries, located three miles north of Lexington. These records have been continued by Mr. Hillenmeyer's sons, Ernest, Louis, and Walter, throughout the years.

In 1872 the Signal Corps of the United States Army opened a weather observatory at State College, later known as the University of Kentucky, but no information is available to explain the reasons for this office being closed between 1876–1879. Beginning with the summer of 1879 and continuing through 1887 their records were kept at the Hillenmeyer Nursery. In 1887 an office was re-established by the Signal Corps in downtown Lexington, but within a year was moved back to the College grounds. The reasons for the removal are not clearly set forth in the records, but in contemporary reports it appears that the press gave little encouragement to the publication of the forecasts and reports, and only a jealousy toward Louisville made sufficient excuse locally for the maintenance of the observatory. A desire by the Experiment Station for records in connection with its agricultural activities seems to be given as one argument for connecting the service with the College. The collecting of climatic data was under the direction of Professor V. E. Munsey for a period of 10 years, but late in 1898 the work was once more undertaken by a regular Weather Bureau official at the expense of the government. As the College grew to the capacity of a University, the Weather Bureau office was increased in equipment and personnel to meet any demands that the University might make of it in an educational way. During the summer of 1906, Mr. C. H. Noyes was placed in charge of the observatory with the rank of Local Forecaster.

In the summer of 1915 the location of the observatory was again changed to a downtown office occasioned by a rising demand on the part of business for the services of the Weather Bureau, a demand which seemed to overshadow the university requirements. Mr. George B. Wurtz became the official in charge and

continued in this capacity until his retirement in 1933. Mrs. E. S. Kinkead took over the work at this time and continued to keep the records until 1944 when the office was transferred to its present location at the Bluegrass Airport, 5 miles west of Lexington, under the direction of the United States Weather Bureau.

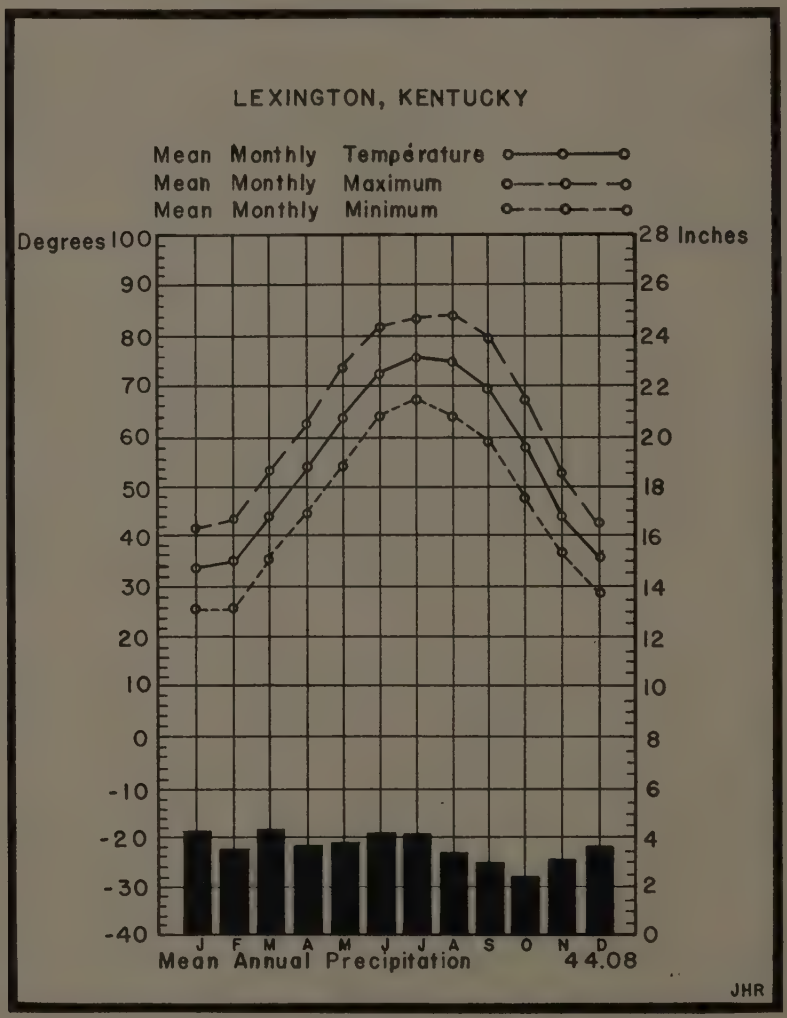

FIGURE 1

Lexington and eastern Kentucky lie within or near the path of moisture bearing cyclonic storms which move from the Gulf region, northeastward over the Mississippi and Ohio Valley regions. Convectional activity which varies greatly in frequency, character, and force is another factor in the summer weather of this region.

Table I and Fig. 1 present a summary of various precipitation and temperature data. The mean monthly precipitation varies from a maximum of 4.33 inches in March to a minimum of 2.45 inches in October. The mean annual precipitation is 44.08 inches. Almost 23 inches of this total, or a little over one-half, falls during the colder half of the year (November to April inclusive). The distribution of precipitation during the seasons is as follows: spring,[1] 11.88 inches; summer, 11.85 inches; autumn, 8.67 inches; and winter, 11.68 inches. This shows that the spring, summer, and winter seasons receive nearly a quarter more precipitation than the autumn months.

TABLE I

PRECIPITATION AND TEMPERATURE AT LEXINGTON: AVERAGES AND EXTREMES
(Length of Record 62 Years)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Average precipitation	4.27	3.68	4.33	3.75	3.80	4.21	4.15	3.49	3.01	2.45	3.21	3.73	44.08
Average number of days with 0.01 inch or more precipitation	14	12	13	12	12	12	11	10	8	8	10	12	134
Average temperature	33.7	34.9	43.9	53.9	64.1	72.9	76.2	74.8	69.5	57.3	44.7	35.8	55.1
Average of the maximum temperature	41.6	43.1	53.1	63.6	73.8	82.5	84.1	84.3	79.4	67.3	53.2	43.3	64.2
Average of the minimum temperature	20.6	26.7	34.7	44.0	54.3	63.4	66.6	63.7	59.3	47.4	36.2	28.4	46.0
Absolute maximum temperature	80	75	86	91	96	104	108	102	101	93	80	71	108
Absolute minimum temperature	—15	—20	—1	15	30	40	47	46	32	21	—3	—9	—20
Highest monthly average temperature	50.9	53.4	65.0	71.7	83.4	91.2	94.0	95.0	90.6	75.7	62.3	58.4	68.8
Lowest monthly average temperature	12.0	15.6	27.6	36.9	47.7	59.3	63.3	61.4	52.3	40.4	29.5	17.5	43.1

TABLE II

DRIEST AND WETTEST MONTHS AND YEAR OF OCCURRENCE AT LEXINGTON

	Driest Month	Year	Wettest Month	Year	Normal
January	0.77	1931	15.10	1937	4.27
February	0.52	1895	11.06	1883	3.68
March	0.46	1910	9.91	1890	4.33
April	0.40	1896	7.36	1872	3.75
May	0.65	1932	11.03	1882	3.80
June	1.05	1864	10.62	1928	4.20
July	0.45	1930	11.24	1875	4.14
August	0.62	1875	8.96	1932	3.48
September	0.33	1895	8.63	1868	3.01
October	0.11	1924	7.95	1919	2.45
November	0.53	1904	8.50	1919	3.21
December	0.80	1925	9.02	1865	3.73
Annual	24.89	1930	65.76	1935	44.08

Table II shows that the difference between the driest and wettest months of record is considerable. The precipitation for the wettest months has varied as

[1] In this paper March, April, and May may be considered as being the spring months; June, July, and August, the summer months; September, October, and November, the autumn months; and December, January, and February, the winter months.

much as 10 to 70 times the minimum with the greatest difference occurring in October (Fig. 2). October, 1924, was the driest month on record with 0.11 inch and January, 1937, the wettest, with 15.10 inches. Each of the months has received less than an inch of precipitation at least once with the exception of June which has had a minimum of 1.05 inches. The difference between the driest year, 1930, with 24.89 inches, and the wettest year, 1935, with 65.76 inches, is greater than 40 inches. This shows a marked contrast within a period of five years.

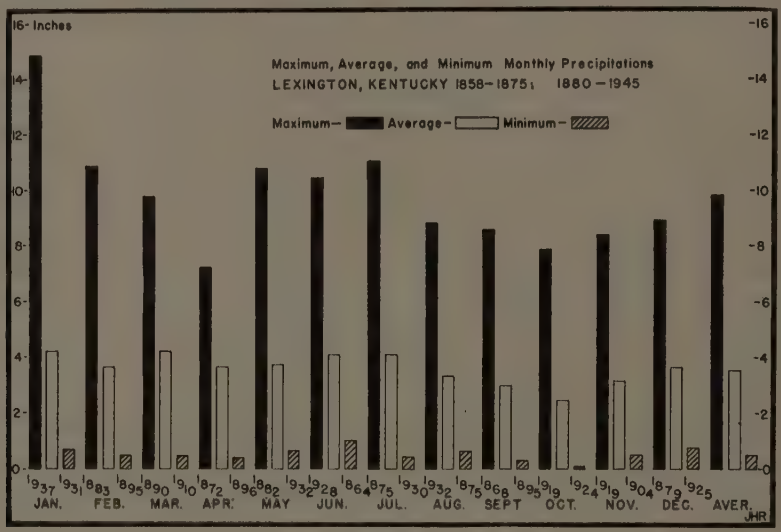

FIGURE 2

Table III shows the late summer and autumn months to be dry more often than the other months of the year. It also shows the same period of the year to have had a lower percentage of months with 5 inches or more of precipitation.

TABLE III

PERCENTAGES OF ALL MONTHS ON RECORD AT LEXINGTON

	Receiving 1.5 inches or less	Receiving 5 inches or more
January	4.8	28.6
February	7.1	17.9
March	6.0	38.1
April	8.3	22.6
May	8.3	25.0
June	3.6	26.2
July	8.3	31.0
August	14.3	20.2
September	17.9	13.1
October	28.6	10.7
November	13.1	17.9
December	3.6	26.2

During the record of 62 years 28% of the Octobers, for instance, had 1.5 inches of precipitation or less but only about 10% of them had 5 inches or more.

The rainfall at Lexington is so well distributed that long periods of continuous wet or dry conditions do not exist without interruptions. Occasionally there is too much rain, especially during the spring months; droughty conditions sometimes prevail in late summer or autumn, but timely rains often occur relieving the situation sufficiently to prevent serious disaster to the principal crops.

The monthly and annual precipitation for an 84-year record, 1858–1945 with the exception of the years 1876–1879 inclusive, has been examined with a few very interesting observations. During this period the annual precipitation exceeded the average of 44.08 inches 40 times, or 47.6% of the time, while it dropped under the average 44 times, or 52.4% of the time. The graph (Fig. 3) showing the departure from normal reveals this fact clearly. The annual rainfall in 72% of the years has been over 40 inches, while 18% of the years it has been in excess of 50 inches; in 6% of the years over 60 inches was received. There were only two years in which the total precipitation fell below 30 inches.

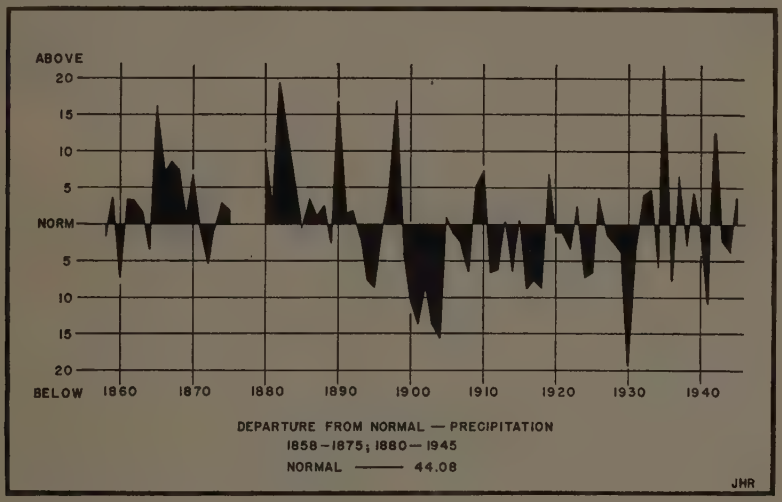

FIGURE 3

The monthly totals of precipitation of one inch or less (a very dry condition) have occurred the following number of times in the 84-year period: January, 1; February, 4; March, 2; April, 3; May, 3; June, 0; July, 5; August, 2; September, 9; October, 17; November, 4; December, 1. As previously shown, October is the driest month with an average of 2.45 inches, but this data reveals that a very dry October occurs 20% of the time or an average of once in five years. The other months of the year, with the exception of September, are very dry only on rare occasions, about 3% of the time, or an average of once in 34 years.

Monthly totals for precipitation of more than twice the expected or average amount have occurred the following number of times at Lexington during the 84-year period: January, 6; February, 9; March, 1; April, 0; May, 4; June, 2; July, 5; August, 7; September, 4; October, 9; November, 4; December, 3. April is the only month in which the precipitation did not double the average amount expected at any time. January, February, August, and October more than doubled the expected on 31 occasions or for a total of 58% of the 54 times that it was doubled. Monthly rainfall totals in excess of 10 inches have occurred 9 times, twice in each of January, May, June, and July and only once in February. The greatest monthly total of 15.10 inches occurred in January, 1937.

Table IV presents data on temperature and precipitation at Lexington over a 62-year period as indicated. Although there are many periods in which rains of an intensity of .01 inch or more fell each day for five or six consecutive days, the longest period on official record is for 11 days. This took place on two different occasions, May 3 to May 23, 1892, and again from August 12 to August 22, 1901. The Hillenmeyer records, somewhat contradictory to this, indicate that rain fell every day during the month of August, 1906; and during the following month of September the sun failed to break through the clouds and there was a trace or more of rain nearly every day. Precipitation of .01 inch or more averages about 134 days each year.

Floods are not unknown in Lexington and neighboring areas, and periods of heavy precipitation have been recorded on different occasions. The most serious flood in Lexington's history took place on August 2, 1932, when more than eight inches of rain fell in 12 hours and Main Street became a turbulent river. On June 28–29, 1928, 5.50 inches fell during the two consecutive days, and on September 3, 1922, 4.12 inches fell in a little over three hours or a total of 5.45 inches for the day. A much earlier record, July 10–12, 1875, reveals a fall of 5.64 inches in an interval of 72 hours. The Hillenmeyer records also show an uninterrupted

TABLE IV

GREATEST NUMBER OF CONSECUTIVE DAYS

(1873–1876, 1888–1945)

Maximum 100° F. or above, 9 days, from July 7 to July 15, 1936.
Maximum 90° F. or above, 21 days, from August 8 to August 28, 1936; also from July 23 to August 12, 1941.
Minimum 32° F. or below, 43 days, from December 25, 1917, to February 5, 1918.
Minimum 20° F. or below, 19 days, from January 3 to January 21, 1893.
Minimum 10° F. or below, 14 days, from January 20 to February 2, 1936.
Minimum 0° F. or below, 7 days, from February 8 to February 14, 1899.
Precipitation .01 inch or more, 11 days, May 3 to May 23, 1892; also August 12 to August 22, 1901.
Precipitation less than .01 inch, 26 days, October 5 to October 30, 1924.

rain of four days duration, September 27–30, 1887, with a total fall of 3.65 inches. Their records also give what is probably a record rainfall for a 30-minute period in Kentucky for on August 16, 1900, a fall of 2.24 inches was recorded in 30 minutes.

Dry periods in which little or no rain is received over periods of 12 to 15 days occur rather regularly in late summer. As a rule it is too late in the season to damage the crops, and in many cases may even be considered beneficial as it aids in the ripening processes. The longest period of consecutive days in which less than .01 inch of precipitation fell occurred between October 5 and October 30, 1924, a period of 26 days. During the year 1930, central Kentucky experienced its worst drought. April and July were extremely dry, all spring and summer months being drier than usual and an annual precipitation of 24.89 inches, the lightest in the history of Lexington.

Records of snowfall for Lexington have been tabulated for all months of the year excepting June, July, August, and September. Traces have been observed as late as May 25 (1925), and as early as October 19 (1930). Snowfall in May and October, however, averages less than a day for each month with a maximum average of five days for January. The average number of days with snowfall is 18 per year distributed as follows: October, –; November, 1; December, 4; January, 5; February, 4; March, 3; April, 1; May, –. The latest heavy snowfall ever recorded in Lexington fell on May 20, 1894, on which date a six-inch snowfall blanketed the city and surrounding country; a killing frost caused serious damage to garden and field crops.

The longest period that snow, with a depth of 1.0 inch or more, has lain on the ground continuously is for 26 days, from January 12 to February 6, 1918. The

maximum snowfall for any single storm occurred between January 13 and 15, 1917, when a total fall of 16.1 inches was recorded; both highway and railway traffic were blocked. The thawing of this snow caused a washout of the gas line serving Lexington and as a result many homes were without heating facilities. On January 26, 1943, 13.4 inches of snow fell during the day which is the heaviest recorded fall within such a period.

Thunderstorms have been recorded for every month of the year, although the maximum intensity occurs in mid-summer. In winter they are usually associated with the cold front of a cyclone while those of summer may be either of the same type or convectional. Probably the most extensive mid-winter electrical storm took place on January 31, 1917, and was accompanied by much thunder. The average monthly distribution of thunderstorms is as follows: January, 1; February, 1; March, 2; April, 4; May, 6; June, 8; July, 9; August, 7; September, 4; October, 1; November, 1; December, 1. There is an average of 45 days a year with thunderstorms, the three summer months having 54% of the total.

Although hail occurs infrequently at Lexington, it does at times result in slight damage to local crops. While no month of the year is immune, November is usually regarded as being less likely to have hail. Some years may experience none whatsoever. The largest hail ever seen in Fayette County fell on May 21, 1917, when stones having a diameter of three and one-quarter inches were reported.

The mean annual temperature at Lexington is 55.1° F. (See Table I), and the mean monthly temperatures range from 33.7° F. in January to 76.2° F. in July, a total of 42.5°F. The absolute range in temperature is from a low of −20°F to a high of 108°F, a total of 128°F. Other temperature data may be observed from a study of Tables I and IV. The range of temperature is great as might be expected from the continental location of Lexington. The city also has a large amount of sunshine during the summer months which often results in high daily and monthly temperatures.

Temperatures of 100° F. or over are rather rare; some summers pass without experiencing it. The highest temperature ever recorded was a reading of 108° F. on July 10 and July 15, 1936. In this same year there were nine consecutive days with a temperature of 100° F. or over, from July 7 to July 15. Temperatures of 100° F. or over, however, have occurred as early as June 27 (1936), and as late as September 14 (1936 and 1939). Between the years 1888 and 1945 only 10 years had recorded temperatures of 100° F. or over, an average of one year in every six. Interesting to note, six of these 10 years with 100° F. or over have occurred between 1934 and 1945 inclusive, during a 12-year period, while the other four were spread between the years 1888 and 1933 inclusive, over a 46-year period. Lexington has had 35 days with a temperature of 100° F. or over during this 58-year period. Four of the 35 days occurred before 1934 and 31 that year and later.

Further study reveals that all years have had temperatures of 90° F. or over: 90° F. readings have been noted as early as April and as late as October; 80° F. readings as early as March and as late as November; and 70° F. readings at some time in every month of the year. The greatest number of consecutive days with a temperature of 90° F. or over has been 21 and was recorded on two different occasions, from August 8 to August 28, 1936, and again in 1941 from July 23 to August 12.

Tables IV and V present minimum temperature data. Subzero temperatures have not been experienced every year, but over the recorded period they have occurred 34 of the 62 years or approximately an average of one year in every two. There have been only 128 days with a temperature of 0° F. or lower, an average of two days every year. Only 17 of the 128 days have experienced a temperature of −10° F. or lower.

The lowest temperature officially recorded in Lexington has been −20° F. on February 13, 1899, and the next lowest −17° F. on February 10 of the same year.

Various unofficial readings from parts of central Kentucky report lower readings, one being −27° F. for February 13. It was the coldest day of a week during which the temperature was below 0° F. every day. Official readings for the week were: February 8, − 4° F.; February 9, −15° F.; February 10, −17° F.; February 11, −4° F.; February 12, −12° F.; February 13, −20° F.; February 14, −1° F. The Kentucky River, solidly frozen, was passable for team and wagon. The latest date with a temperature of below 0.° F. was March 4 (1873) with a reading of −1° F. The earliest date was November 29 (1929) with a reading of 0° F., followed by −3° F. the next day.

It is interesting to note that 28 of the 34 years with 0° F. or below occurred between the years 1888–1933, the same period that only four years had tem-

TABLE V

MINIMUM TEMPERATURE DATA

A—Number of Days Considered
B—Number of Days with indicated Minimum
C—Percentage of Total

	Jan.	Feb.	Mar.	Apr.	May	Sept.	Oct.	Nov.	Dec.
32°F OR BELOW									
A	1922	1751	1922	1860	1922	1860	1922	1860	1922
B	1380	1207	857	224	3	1	107	675	1227
C	71.2	68.9	44.6	12.0	.16	.05	5.6	36.3	69.2
20°F OR BELOW									
A	1922	1751	1922	1860	.....	.....	.....	1860	1922
B	524	498	161	5	.....	.....	.....	93	424
C	27.3	28.4	8.4	.27	.....	.....	.....	5.0	22.1
10°F OR BELOW									
A	1922	1751	1922	.....	.....	.....	.....	1860	1922
B	225	176	23	.....	.....	.....	.....	8	120
C	11.7	10.1	1.2	.....	.....	.....	.....	.43	6.2
0°F OR BELOW									
A	1922	1751	1922	.....	.....	.....	.....	1860	1922
B	62	41	1	.....	.....	.....	.....	2	22
C	3.2	2.3	.05	.....	.....	.....	.....	.11	1.1

peratures of 100° F. or over. In the interval, 1934–1945 inclusive, a temperature of 0° F. or lower was recorded in six of the years. As has been shown previously, this was the time when maximum readings of 100° F. or over had been observed six years out of a total of ten during the 58-year period considered. This would seem to indicate that there has been a slight shift from cooler to warmer conditions, however, the time period is too short for any definite conclusions.

Table V, Minimum Temperature Data, enables one to compare the number of days of a given minimum temperature with the total number of possible days and to observe the percentage of the total. For example, there were 1,922 days in the 62 Januarys considered. Of these, 1,380 days had temperatures of 32°F or below at some time during the day, or a total of 71.2% of all days in January. It will be seen that January is the coldest month with February and December slightly less so. The latest date with a temperature of 32°F occurred on May 20, 1894, and the earliest date occurred on September 30, 1899.

The average length of the frost-free season is 189 days; in four-fifths of the years it is 178 days. The latest last killing frost in spring ever officially recorded was on May 20, 1894, and the earliest first killing frost in the autumn was on September 24, 1928. The last killing frost in spring occurs on the average on April 16 and in the autumn the average date of the first killing frost is October 22. In four-fifths of the years the last killing frost in spring comes about April 23 and the first killing frost in the autumn comes about October 18. The longest frost-free season has been 233 days and this has occurred on two different occasions during the recorded period. In 1902 the frost-free period was from April 8 to November 27, and in 1922 from March 22 to November 10. The shortest frost-free period was 142 days in 1894, from May 20 to October 9.

The relative humidity at noon, local time, reaches an average of 74% in winter, 61% in spring, 58% in summer, and 62% in atumn. The relative humidity at8 a. m. is somewhat higher with values of 82, 76, 78 and 79% respectively.

The average number of days with dense fog is 11 per annum, the greatest number of these occurring in late atumn and the winter months. The months of March, April, May, June, and July average less than a day each; August, September, and October have an average of one each; and November, December, January, and February have an average of two each.

Over a period of 32 years, records show the percentage of possible sunshine to be greater in summer than in winter; 63% in July and August in contrast with only 35% in December. Distribution of possible sunshine by seasons is as follows: winter, 37%; spring, 52%; summer, 62%; autumn, 55%. Summer not only has a greater percentage of possible sunshine but its hours of sunshine is about 60% more than in winter, 15 hours in June as contrasted with 9 hours in December. The summer sunshine is also more intense than that of winter since the altitude of the sun in June is 75° 28′ while in December it is 28° 28′. The number of gram calories of heat per square centimeter of surface in June on a clear day is about 800 while that in December is only 270.

The prevailing wind direction for Lexington is from the southwest throughout each month of the year over a 42-year period. The average wind velocity ranges from 10 to 12 miles per hour, with values somewhat higher during the winter months and reaching a maximum average velocity of 13.2 miles per hour in March. The wind probably reached one of its greatest measured velocities in 1918 when a maximum of 56 miles per hour was recorded. Severe winds associated with tornadoes or tornado-like storms have been recorded on different occasions.

This study does not fully present nor does it attempt to analyze all the phenomena of the weather and climate of Lexington. Such a task is beyond the purpose of this paper. The data selected and method of presentation may be improved upon; however, it is hoped that sufficient material has been assembled which will stimulate others to make similar studies, so that information relative to our weather and climate may be made available to all.

MORPHOLOGY OF SPIRONEMA FRAGRANS, LINDL.

H. H. M. BOWMAN,
University of Toledo,
Toledo, Ohio

About eight years ago a friend gave me a small potted plant—a monocot with an attractive whorl of dark green leaves resembling *Dracaena*. This grew into a high plant which began to lean and sprawl with its heavy crown of long leaves; next, it produced from the lower nodes long runner-like branches which quickly rooted in the soil in the green-house bench in which it's pot had been placed. These off-sets I gave to friends as interesting house-plants. As the sprawling parent

FIG. 1. Three year old plant of *Spironema fragrans* in early stage of blooming.

plant became more awkward and ungainly with its numerous progeny around it forming a sort of jungle, I would discard the old plants and raise new ones as mere foliage plants, since it never bloomed. Without any flowers I could not identify it. I kept it as rampant but barren tropical stranger in our green-house collection.

Finally in the spring of 1948 an old plant which I had kept as an ungainly relic became mature enough to bloom (Fig. 1). In February it suddenly sent up a long naked wand-like stem which eventually developed lateral shoots. These ulti-

mately produced dense clusters of small deliciously fragrant white flowers (Fig. 2) that filled the green-house with their perfume. As I had no keys for tropical monocots which were not common in horticulture, I made sketches of the plant and its flowers and sent them to the Bronx Botanical Garden in New York. The assistant curator, Mr. Richard Howard, sent me its name—*Spironema fragrans*.

FIG. 2. Inflorescence of *Spironema fragrans* at mature stage of bloom.

Its nomenclature has gone through numerous vicissitudes. Its earliest generic name was *Callisia* given by Linnaeus (1) in 1758. A specimen had apparently been sent to Linnaeus at Upsala, Sweden, by his former student, Pehr Löfling (2), whom it will be recalled was designated by Linnaeus as his best loved pupil. Löfling

had in later years become botanist to the Spanish Government in Madrid. In this capacity he went on a botanical exploration trip to South America where he died.

In his collections he sent back the plant which was named *Callisia* by his old teacher, Linnaeus.

In 1763 the genus was renamed *Hapolanthus* by the Austrian Botanist, Nicolaus Jacquin (3) and in 1840 the English collector and student of American plants, John Lindley (4) christened it *Spironema*. This was its valid name until 1903 when John K. Small (5) of the Bronx Botanical Garden put it in the genus *Tradescantella*.

By this one can surmise that the plant is a member of the Commelinaceae in the Division Tradescantiae.

FIG. 3. Magnified flower of *Spironema fragrans* × 20.

In 1942, Robert E. Woodson (6) of the Missouri Botanical Garden and who is at present writing a *Flora of Panama* (7) contributed an article to the Annals of the Missouri Botanical Garden entitled "A Commentary on the North American Genera of Commelinaceae." He described the plant under the name, *Callisia fragrans* (Lindl.) Woodson *Comb. nov.*

The plant's relationship to the genus *Callisia* is not very patent. The older authors describe the genus as composed of "small prostrate running herbs with umbelliform, few flowered, inflorescences." Woodson says of *C. fragrans*, "aside from its gigantic size the relationship of this species to the small creeping plants of *Callisia* should be sufficiently clear."

But in spite of Woodson's statement it is not *sufficiently clear* that it should be included in *Callisia* as originally named by Linnaeus. The more logical nomen-

clature would therefore be that favored by Engler and Prantl (8) and the Bronx Botanical Garden to retain Lindley's (1840) name of *Spironema* since in its habit it is strikingly different from the creeping species of *Callisia*.

The flowers are held aloft in spike-like wands 3 to 4 feet tall (Fig. 2). They are borne in compact globose clusters in the axils of tiny bracts and like most of its relatives in this family are ephemeral. They open about 9:30 in the morning and all are shriveled and finished by 3:30 P. M. The blooming is also sporadic. On March 20 of the year 1949, all of 5 large old plants burst into bloom simultaneously for one day. Then no flowers opened until March 29, then a bloomless period until April 5, and again no flowers until April 10. These sudden and irregular

FIG. 4. Floral parts of *Spironema fragrans*. Drawings by H. H. M. Bowman.

spurts of bloom were not apparently due to the quantity of light nor the temperature, since the latter was uniform in the green-house and some of the blooming dates were clouded dark days and others were sunny.

The individual flowers (Fig. 3) are most unusual especially with regard to the stamens. The perianth is about one-fourth inch in diameter and 6-parted. The three outer divisions are of a firmer texture with a slight greenish or purplish streak on the outer side. The three inner divisions are broader and more petal-like and of a delicate transparent whiteness. In the center is the pistil with a 3-celled superior ovary with 2 ovules in each cell, a filiform style is topped by a tufted plumose capitate stigma. The stamens are 6 with very long spreading thread-like

filaments which are about an inch in length, and elevated far beyond the cup of the perinth. The connective of the stamen is exaggerated into an irregularly rounded-petal-like expanse of delicate white tissue with two small anther-sacs in the lower outer corners of the connective. These are filled with rice-shaped pollen grains. The delicate petal-like stamens with their long exserted filaments give a filmy or feathery character to the entire inflorescence (Fig. 4). Engler and Prantl give the only illustration of the stamens that I have been able to find but their drawing is incorrect. The connective is described as quadratic and the anther sacs are shown at the upper outer corners instead of the lower corners.

How this tropical jungle plant from Central and South America came to Toledo I am unable to say. It does not seem to be known to commercial firms and so far as I know is not grown as an ornamental plant by horticulturists. It is my purpose to introduce to you therefore a plant little known in our latitude and one which is remarkable in its stamens and peculiar habits of growth. Photographs of the plants in the University green-house and my original drawings illustrate the morphological features of *Spironema fragrans* Lindl.

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SOME RECENT RECORDS OF THE FRESH-WATER JELLYFISH CRASPEDACUSTA SOWERBII FROM OHIO AND PENNSYLVANIA[1]

RALPH W. DEXTER,
Kent State University,

THOMAS C. SURRARRER,
Baldwin-Wallace College,

AND

CHARLES W. DAVIS,
Youngstown College

During the past two decades much interest has been shown in the freshwater jellyfish *Craspedacusta sowerbii* Lancaster. A monograph on the species by Dejdar (1934) tabulated all of the world-wide records of occurrence known up to the date of his study. Bennett (1932) had earlier summarized the published accounts from North America, and Schmitt (1939) and Zeliff (1940) have added to the compilation of North American records. Pennsylvania records begin with the discovery in 1885 of the hydroid stage of this hydrozoan coelenterate by Potts who described it as *Microhydra ryderi*. In 1897 he reported the discovery of the medusa stage. This was followed by a series of published observations and studies of which the publication of 1906 is the most important. Payne (1924) has shown the relation of the hydroid to the medusa stage and has shown that the generic name of Craspedacusta takes precedence over that of Microhydra. However, he retained the trivial name *ryderi* for the American specimens. Boulenger and Flower (1929) and Dejdar (1934) demonstrated that *C. ryderi* is identical with *C. sowerbii* as described originally by Lancaster from specimens first discovered in the lily tank of Regent's Park in 1880 and which reappeared in 1928. American writers of recent years have used both names, one about as often as the other. It seems to the writers, however, that *C. sowerbii* should be regarded as the valid name. Additional records from Pennsylvania have been published by Brooks (1932), Quick and Matthews (1937), and Kuster (1938). Collecting records from Ohio have been reported by Baird (1932), Kraatz (1933), Linscheid (1935), Kostir (1941), and Dunham (1941–42).

Many persons have kindly assisted the writers with their studies and with the compilation of other new discoveries of *C. sowerbii* in the Ohio-Pennsylvania region. These who have contributed collecting data are mentioned in connection with their records, and to them our sincere thanks are given. Others to whom we are indebted for assistance are as follows: Dr. Fernandus Payne, Dr. J. Paul Visscher, Mrs. Martha Linscheid, Mr. Paul Shively, Mr. Blake B. Hanan, Mr. H. K. Datson, and the General Biological Supply House. In making state-wide contacts regarding the occurrence of fresh-water jellyfish in Ohio, the senior writer learned of the work of Dr. Surrarrer and Mr. Davis on this species. They were invited to join him in the production of this combined report, and acknowledgment is hereby given to their splendid cooperation.

NEW RECORDS FROM OHIO

Alfred G. Linscheid of the Shaker Heights Schools found an abundance of fresh-water medusae in Green Lake at Shaker Heights in the fall of 1934. Specimens had first been brought to him by a student of his school, H. V. Caldwell, Jr., but

[1]Presented before the zoology section of the Ohio Academy of Science, April 22, 1949, at Denison University.

none has been found there since that time. In October of that same year, abundant medusae were discovered in a goldfish pond at Nela Park in Cleveland Heights. These were studied by Mrs. Martha Linscheid who prepared a master's thesis on her studies for Western Reserve University (Linscheid, 1935) and presented a report of her work before the Ohio Academy of Science in the spring of 1935. Since that time Mr. Henry Donahower, who made the original discovery, has seen small numbers of medusae during various years but unfortunately written records were not made. In the last week of August, 1948, four specimens were collected. We were notified of this recent collection through the courtesy of Mrs. Harold R. Nissley. The pool, formerly a fire pool but now converted into an ornamental goldfish pond, is circular, has a diameter of 125 feet, a depth of 15 feet, and a capacity of 1.25 million gallons. It was constructed in about 1912. In spite of periodic cleaning of the pond every three to five years, the jellyfish have reappeared over a span of 14 years. Schmitt (1939) cited a number of similar cases where jellyfish have reappeared in the same artificial pool over a period of years.

Dr. William C. Stehr of Ohio University has collected medusae from a reservoir three miles north of Athens during late May and June every year since 1934. Only female specimens have so far been observed. Their abundance has fluctuated from year to year, but he found them particularly abundant in 1937 and 1942.

In September of 1936 and 1937, Prof. George R. Easterling of Kent State University collected medusae from a sand-pit quarry pond two miles northwest of Chillicothe. They were common in 1936, but much less numerous the second year. The pond was circular in outline with a diameter of about 200 feet and a maximum depth of 10–12 feet.

In August of 1940, fresh-water jellyfish were found in Round Lake, near Route 3 some 12 miles southwest of Wooster, in the corner junction of Holmes, Ashland, and Wayne Counties. Specimens were brought to the College of Wooster. Dr. Ralph V. Bangham of the college visited the lake within a short time after the discovery and collected a few specimens. Round Lake is a small, pot-hole type of lake with a maximum depth of about 45–50 feet and with margins of peat bog. It has a water surface of 35 acres. On August 13, 1949, Mr. Parke C. Wachtel of Mansfield discovered a number of fresh-water jellyfish on the west side of the lake in a section of less than an acre in area and with a depth ranging from 15 to 25 feet. He had fished this lake at least once each week and sometimes twice a week since April 1, but no jellyfish were observed until the 13th of August. Apparently they appeared sometimes between April 6 and 13. On August 20 the medusae were found in great abundance, but one week later they were much reduced in number. On August 30 he captured many specimens which were sent to Mr. E. L. Wickliff, Chief of the Fish Management Section of the Ohio Division of Wildlife, who placed them on exhibition at the Ohio State Fair. On September3, Mr. Wachtel found only a few specimens still remaining in the lake, and by September 10 they had disappeared.

Blake B. Hanan collected specimens of *C. sowerbii* in the months of August, September, and October of 1941 from an old stone quarry lake (Smith quarry) near Berea (see figure 1) which had been abandoned for some 25 years. Some of the specimens were forwarded to Kent State University. He found the medusae in great numbers especially along the edges of the water where 2–3 specimens were found per square yard from the surface to a depth of about four feet. The body of water filling the quarry measured approximately 150 x 600 feet with an estimated depth of 60–70 feet. That same year Dr. Thomas C. Surrarrer collected specimens in October from the same quarry. The eight specimens which have been saved are all males. The gonads of 50 specimens, probably all of them males, placed in aquaria on October 21, ruptured on October 30. Other quarries in the vicinity which were examined did not yield any jellyfish that year. In September of 1942, *C. sowerbii* was again collected from Smith quarry but it was less abundant

than in the preceding year. In October of 1943, only a few specimens could be found there. This quarry was then drained and reworked, but soon abandoned once more. After its being refilled with water, medusae were not found again after a careful search in 1946, 1947, and 1948. In the fall of the years 1943–1947 inclusive, a number of jellyfish were found each year in a nearby quarry, West View quarry, but none was found there in 1948. In 1947, however, they were also present in a second quarry at West View. This one had been drained in 1944 and reworked for a time. Jellyfish were not found there in earlier years or in 1948. All three of these quarries at Berea were filled with deep-blue, clear water.

Mr. T. G. Gallagher, Chief of the Pollution Control Section of the Ohio Division of Conservation, discovered an abundant population of fresh-water medusae in Lake Alma in July of 1945. While fishing in the lake he observed a slowly moving stream of the jellyfish some 20 feet wide and about 200 yards long which moved in a counterclockwise direction around an island in the lake. One dip of a quart jar captured 17 individuals. They ranged in size from one-quarter of an inch to one inch in diameter, the average being about three-fourths of an inch. At the time

FIG. 1. Smith quarry near Berea. Typical quarry habitat of *Craspedacusta sowerbii*. Photo by Blake B. Hanan.

of collecting, the surface water was 79°F. with a drop to 75°F. at a depth of 12 feet. The pH reading one foot below the surface was 6.4. The captured medusae were placed in an aquarium with two guppies, both of which were dead by the next morning. One of the fish had a large jellyfish clamped to it by its tentacles. Lake Alma is in Clinton Township of Vinton County, about two miles southeast of Hamden. It is an impounded lake built in 1900. An earthen dam has created a somewhat circular lake with an island near the center. There is a surface of 72.5 acres of water, an average depth of 9.7 feet, and maximum depth of a little over 16 feet. Roach and Pelton (1947) have published a limnological and fishery management survey report on this lake.

In September, 1947, a student of Kent State University brought to the biology laboratories a number of living medusae which he had collected from Stewart Lake, near Twin Lakes, in which they were very common. These were kept alive for several days as a demonstration in the laboratories. At the same time the senior writer heard of a report of jellyfish from Crystal Lake near Ravenna, only nine miles from Stewart Lake. Several specimens had been collected on August 31 by two students, Helen Stuart and George Price. On September 24, the lake was visited, at which time *C. sowerbii* was found to be still abundant. They were

widely distributed over the lake, but were particularly common on the leeward side. Three days later Walter Evans, a school boy living at the lake, collected a few specimens, but no more were seen after that date. All of the 42 specimens preserved from this lake were females. The size ranged from 6–12 mm. in diameter and the tentacles were arranged in six different size groups. Cladocerans and copepods were found entangled in the tentacles. Crystal Lake is a natural glacial lake of approximately 25 acres and with a greatest depth of about 30 feet. It is used as a water supply for the City of Ravenna and for sport fishing. Fishermen reported difficulty in getting fish to bite during the time when the jellyfish were at their peak of abundance. Possibly the fish were feeding on the medusae. Two fishermen, Howard Kastor and Gordon Klohn, claim to have seen a few jellyfish in this lake each year between 1937 and 1947, and a considerable number in about 1942. How dependable those observations were cannot be stated since specimens were not collected. In August, 1948, a total of four specimens was collected by Walter Evans which were the only ones found that year at Crystal Lake.

Also in the summer and fall of 1947, abundant specimens were collected from Lake Milton, 14 miles east of Crystal Lake. Charles W. Davis, assisted by Dr. Claire L. Worley of Youngstown College, collected medusae from a small bay of Lake Milton. In 17 years of living on the shore of this bay, the Davis family had never previously observed jellyfish in the lake. Many specimens were collected during the first two weeks of May. From the middle of June to the middle of July the jellyfish were most abundant. From the middle of July to August 10 only a few were seen, but after this date they became abundant again until the first week of September when they decreased in number. Few were obtained in September and none observed in October. All of the specimens observed that year were found restricted to the small bay directly in front of the Davis cottage, and for the most part centered around a snag of tree branches some 30 feet in diameter which had been submerged at the spot for attracting game fish. Jellyfish were observed floating up out of this snag. By striking the submerged branches with a boat oar, many individuals were liberated which came to the surface. Specimens which were preserved, about 25 in number, were all females (see figure 2). Lake Milton was impounded in 1916 in the Mahoning River Valley to supply water for the steel plants of Youngstown. It has an area at present of 1,700 acres, with a maximum depth of about 46 feet. The average depth is 12 feet. At no other place in the lake, however, have medusae yet been observed. The size of preserved specimens are the same as those collected from Crystal Lake, 6–12 mm., but some were observed in the water by Mr. Davis that were about 30 mm. in diameter. In the summer of 1948 the medusae did not appear until the first week of September. Mr. Glen Davis, owner of the Davis cottage, collected about 10 specimens at that time from the same location. They were fairly numerous for two weeks, but not nearly so abundant as they had been the preceding year. Two fishermen reported observing them in middle September, having found them over the same snag. The senior writer, accompanied by Mr. Glen Davis, was unable to find any on September 26.

Prof. William Adams, Jr. and Prof. W. Hughes Barnes of Muskingum College collected abundant specimens of *C. sowerbii* from a limestone quarry near Zanesville between July and October of 1947 and 1948. They plan to publish the detailed results of their observations at a later date.

NEW RECORDS FROM PENNSYLVANIA

Prof. Kimber C. Kuster of the State Teachers College, Bloomsburg, Pennsylvania, published a note (1938) on the collection of medusae from an abandoned limestone quarry near the village of Almedia, Columbia County, from August to October of 1937. He has written to us that since that time medusae have been found every summer in the same quarry until the season of 1947 when they were

neither observed by him nor reported to him by bathers. During the ten-year interval when medusae were observed, they varied in abundance from one year to another, being very common some years and much less common other years.

Mr. David Shortess collected a great abundance of medusae for the General Biological Supply House from Fox Run, a slow-moving stream, some five miles northwest of York in the late summer of 1946. The stream is 25 feet wide and not over three feet deep where the collection was made. Shortly after his specimens were collected a rain storm swelled the stream, sweeping away the population, and medusae have not been found there since. He observed two color groups, "clear white" and "greenish."

On September 15 and 16, 1947, Ladd Heldenbrand, a student at Kent State University at the time, discovered fresh-water jellyfish in abundance at the northern

FIG. 2. *Craspedacusta sowerbii* from Lake Milton, 1947.
Photo by H. K. Datson.

end of Lake Wallenpaupack. Attempts to capture specimens with his hands failed. Unfortunately collecting equipment was not available. However, since he had previously studied preserved specimens in the zoological laboratories and he was able to make close observation of large numbers in the lake, there can be no question as to the correctness of his identification This lake was impounded in the Wallenpaupack River in 1923 for hydroelectric power by the Pennsylvania Power and Light Company of Scranton. The lake is some 30 miles east of Scranton. It is 12 miles long with an average width of two miles. Total area is 216,000 acres, and greatest depth is 90 feet. The medusae were found over a stretch of about three miles. In the summer of 1948 Mr. Heldenbrand returned with collecting equipment, but specimens were neither found nor reported by anyone on the lake. On September 5, 1949, however, he succeeded in collecting specimens of *C. sowerbii* which were found in abundance distributed throughout an area of

about one square mile. Thirty-seven specimens sent to the senior writer for study ranged in size from 7–15 mm., the great majority being 12–15 mm. All of these specimens were females, and all of the loose gonads from broken medusae were ovaries. At the time of collecting, the surface water was very still and its temperature was 68° F. The following day no specimens could be found. Deevey and Brooks (1943) reported *C. sowerbii* from a lake in Connecticut with an area of 271 acres and a maximum depth of 65 feet. They claimed that it was the first record of fresh-water medusae from an open lake. The above discovery of medusae in Lake Wallenpaupack enlarges the known lake-size habitat of this organism many times.

NOTES ON HABITAT, SEASONAL OCCURRENCE AND GEOGRAPHICAL DISTRIBUTION

Fresh-water medusae have been most often found in quarry and fish ponds, concrete pools and tanks, gravel pits, and small shallow lakes. This paper reports specimens from two large impounded lakes, Lake Milton and Lake Wallenpaupack, both of which are much larger than any previously reported lake habitat. One stream population, that of Fox Run, is added to the few records of such a habitat known from North America. Previously, Takony Creek and the Schuykill River in Pennsylvania, the Vermillion River in Ohio, Benson Creek and the Kentucky River in Kentucky, and Williamette River in Oregon have been reported. The statement of Dejdar (1934) that *C. sowerbii* is found "in natural lakes that are apparently always connected with flowing water" is certainly not the case in many of the American records made from such habitats as artificial goldfish ponds, quarry ponds, concrete tanks, etc.

Many zoologists believe that the hydroid stage is introduced into bodies of water with transplanted water plants or fish, and that it reproduces by asexual budding only. Thus is explained the collecting of males only by Viosca and Burkenroad (1936), Van Auken (Loudonville specimens) (1940), Deevey and Brooks (1943), Fincher and Buchanan (1944), and from the Berea quarries described in this paper; and of females only by Payne (1924), Baird (1932), Woodhead (1933), Milne (1938), Powers (1938), Van Auken (Garnet Lake specimens) (1940), and from a reservoir near Athens, Crystal Lake, and Lake Milton as mentioned in this paper. Only Payne (1926) has reported collecting both sexes together. He concluded that in budding off medusae the hydroids are apparently male producing or female producing exclusively. The matter was summarized in an unpublished report by Kostir (1941).

Schmitt (1939) repeated his prediction made 12 years earlier that more and more specimens of the sporadic and relatively rare fresh-water medusae would be found and reported as more attention over a wider area was turned to the problem. In addition to the increase in the number and distribution of observers, another factor which seems to bring records of occurrence to light is that certain years are apparently favorable ones for the production of this organism in great quantity. The years of 1932, 1933, 1934, 1936, 1937, and 1947 were times when most of the recent North American records have been discovered and years when jellyfish were found in great abundance.

Most of the collecting in this country has been done from July to October, although records are known as early as May and as late as November. September is the month of most frequent discovery and greatest abundance.

Fresh-water medusae have been reported from 25 states (Conn., N. Y., N. J., Penn., Md., Va., W. Va., Ohio, Mich., Ind., Ill., Ky., Tenn., Ga., Ala., Miss., La., Ark., Mo., Iowa, Texas, Okla., Kan., Ore., and Wash.), Washington D. C., Quebec, and the Panama Canal Zone. All of the state records except Oregon and Washington (aquarium record only from Washington) are in the eastern half of the United States.

SUMMARY

1. The fresh-water medusa *Craspedacusta sowerbii* is reported from 12 new localities in Ohio and Pennsylvania and from two previously known localities in which it has reappeared.

2. Two lake habitats are recorded, Lake Milton in Ohio and Lake Wallenpaupack in Pennsylvania, which are the largest yet known to be inhabited by jellyfish.

3. Medusae are usually found from July to October in quarry and fish ponds, reservoirs, and small lakes.

4. A new stream record (Fox Run in Pennsylvania) is reported for North America.

5. All state and similar locality records known from North America are listed.

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A MANOMETRIC PIPETTING DEVICE

BERTIL G. ANDERSON,
Department of Biology, West Virginia University, and
Franz Theodore Stone Laboratory, The Ohio State University

The pipetting device herein described has enabled me to make 100 ml. dilutions faster and with much less fatigue than the pipetting by mouth method. The device can be used in a variety of situations where definite volumes are to be dispensed. It can also be used where a safety pipette is desirable especially with radioactive materials. Cleaning time is less than for other types of automatic and mechanical dispensing devices since the only part that requires cleaning is the pipette. The principle involved is simple so that others may have developed essentially similar devices but so far as I am aware they have not been described.

The device is diagrammed in Fig. 1. The pipette may be of any size and type that is emptied completely. This is connected by means of a rubber tube to a gas collecting tube of 250 ml. capacity. The gas collecting tube is in turn connected by means of a second rubber tube to a leveling bulb of 250 ml. capacity. These parts are supported on a stand with a heavy base and a rod 36 in. long and 0.5 in. in diameter. The pipette is held by a burette clamp. The gas collecting tube is held by a large burette clamp. A fixed leveling bulb support is mounted above the gas collecting tube at a level to hold the upper end of the tubulation of the leveling bulb 2–3 cm. below the upper end of the expanded portion of the gas collecting tube. An adjustable leveling bulb support is mounted below the gas collecting tube. After the apparatus is assembled it is filled with water to the level shown in Fig. 1.

The pipetting procedure is as follows: Place the leveling bulb in the fixed support. Adjust the lower leveling bulb support so that the distance between it and the fixed support is a centimeter or two greater than the distance between the tip of the pipette and the graduation mark. If the density of the liquid to be dispensed is different from that of water the distance should be proportional to the specific gravity of the liquid. To fill the pipette a vessel containing the liquid to be dispensed is raised to immerse the tip of the pipette and the leveling bulb lowered to the adjustable support. If the adjustable leveling bulb support is adjusted precisely the liquid level in the pipette will drop to the graduation mark on withdrawing the vessel. If the liquid level in the pipette falls below the graduation mark the vessel should again be raised to the pipette and the adjustable support lowered until the liquid level in the pipette falls to the graduation mark on withdrawing the vessel. If the liquid level falls above the graduation mark the adjustable support should be raised until the liquid level falls to the graduation mark The pipette is emptied by raising the leveling bulb to the fixed support. Once adjusted to a pipette only minor adjustments need be made from time to time.

Any type and size of pipette can be used with this device. Mohr type pipettes have been used by adding a second adjustable leveling bulb support below the fixed support and adjusted to stop the emptying of the pipette at a given graduation mark. The pipette itself may be mounted on a separate support which may be at a distance from the remainder of the apparatus. In this way the device can be used advantageously in pipetting radioactive materials.

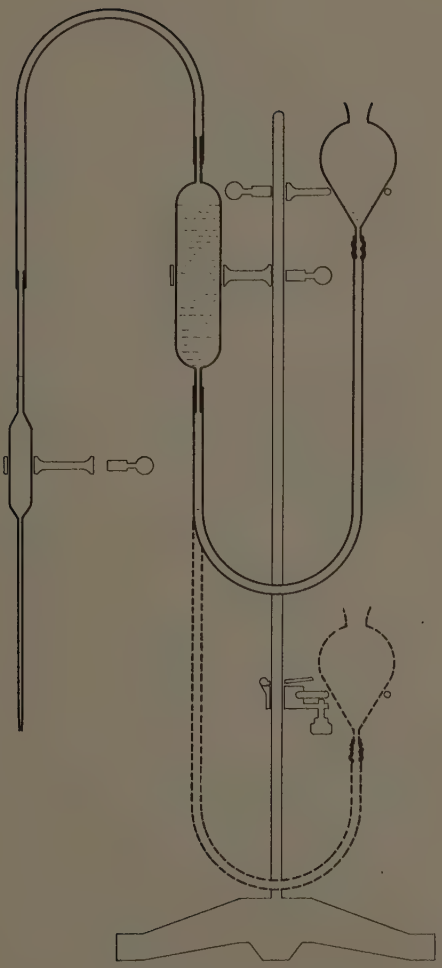

FIG. 1. A manometric pipetting device.

NEW SPECIES OF NEW WORLD BACCHA

F. M. HULL,
University of Mississippi

Several new species of American flies of the Syrphid genus *Baccha* are here described. The types are in the author's collection.

Baccha zabulon n. sp.

Related to *vespuccia* Hull and *brunnipennis* Hull. The hind femora and tibiae are quite pale yellow, not brown; the femora are blackish annulate. Wings slightly paler in color, the V-shaped yellow spots of the fourth segment are more broadly joined to the minute, yellow, basal triangles. Length 9 mm.

Female.— *Head:* face and cheeks pale yellow, the front yellow, except for a medial brownish stripe running three-fourths of the length of the front. The preantennal callus is brownish above with a small black spot anteriorly. The first two segments of the antennae are yellow, the third is missing. The vertex is black with golden-brown pollen; the black pile lies in a single row. Pile of front black, of face yellow. Occiput black with yellowish grey pollen and golden, non-flattened pile, the pile of the upper third black. *Thorax:* mesonotum black, quite widely pale yellow along the sides including the humeri and post calli and the whole of the scutellum. The scutellum is barely darker in oblique view but appears clearly yellow from above. The middle of the mesonotum is obscurely vittate with yellowish or reddish brown pollen. There is no anterior collar and the pile is sparse and yellowish. The pile of the scutellum consists of a very few long fine black hairs. There appears to be no ventral fringe. The pleura are yellow with a diagonal brownish black band posteriorly, occupying the sternopleura, metapleura and hypopleura. Squamae and fringe dark sepia. Halteres light reddish brown. *Legs:* all coxae and trochanters yellow. The anterior and middle legs and the whole of the hind legs, except a distinct wide, brown, subapical, femoral annulus, are yellow in color. *Wings:* uniformly tinged with light brown, the pterostigma scarcely darker. The third vein is gently arched, the costa drawn backward, the preanal spuria distinct, the alulae narrow, not wider than the width of the basal section of the costal cell. *Abdomen:* spatulate but little narrowed basally. The first segment is yellow with the posterior margin brown except upon the sides. The second segment is one and two-thirds as long as wide; just before the middle there is a broad, gently arched yellow band bordered anteriorly and posteriorly with opaque reddish-sepia. The third segment is similar, a little shorter, a little wider posteriorly and the yellow band is now narrowly divided in the middle, wider in the middle and located in the middle of the segment. Thus, this segment has a pair of closely approximate, yellowish triangles which reach narrowly to the lateral margin and which are bordered by opaque sepia. The fourth segment has on either side a deep-cleft, inverted, V-shaped spot which is rather broadly connected to the minute, submedial, basal yellow triangles. The outer limb of the "V" is broadly rounded and at least twice as wide outwardly as basally, the medial limbs of either side slightly converge posteriorly, are broadly rounded medially and their tips diverge and do not reach the posterior margin. These yellow figures are narrowly margined anteriorly with opaque brown and the clefts and medial space is filled with opaque brown. Fifth segment with a pair of submedial vittae similar to those of the fourth segment and with a pair of shorter, diagonal, sublateral yellow vittae which narrowly connect with a submedial pair at the base. The submedial vittae reach the posterior margin. Sixth segment yellow with two slender brownish black vittae.

Holotype: female, Chanchamayo, Peru, August 20, 1948, J. Schunke.

Baccha halcyone n. sp.

Related to *verona* Curran. The U-shaped yellow spots of abdominal segments three and four are not so deeply cleft, the fifth segment is quadrivittate. Length 6.5 mm.

Male.—*Head:* face, cheeks and front entirely pale yellow, the latter with a very minute, scarcely noticeable pale brown spot on the pre-antennal callus instead of the usual distinct black spot. The pile of the front is blackish, of the face yellow. The antennae are orange, the arista blackish. The vertex is blackish, the occiput black, somewhat crumpled and greasy. *Thorax:* mesonotum black with brassy reflections, the pollen obscured by poor preservation; the sides of the mesonotum including the humeri, postcalli and the scutellum are pale yellow. There is no anterior collar of pile. The mesonotal hair is fine and dark in color. Similarly the scutellar pile is sparse, fine, long and black. Ventral scutellar fringe absent. The pleura are pale yellow, the lower sternopleura, the metapleura and hypopleura sepia-brown. Squamae brown, the halteres sepia with the stalk pale. *Legs:* anterior and middle legs entirely pale yellow. The posterior fringe of the middle femora yellow, the hind femora with dark brown, wide, subapical annulus and less distinctly brown at the base. Hind tibiae biannulate, being light brown apically and just before the middle. Hind tarsi entirely yellow. *Wings:* not quite hyaline, the pterostigma pale brown. Alula quite absent. The preanal spuria is almost completely absent. The third vein is gently arched, the costa drawn considerably backwards. *Abdomen:* petiolate, the first segment yellow, shining brown posteriorly except upon the sides. The second segment is subcylindrical, three to three and a half times as long as its middle width; it is sepia brown in color except that the sides upon the basal half are diffusely shining yellowish but the yellow color is scarcely visible from above. Just past the middle there are a pair of narrowly separated, sharp, distinct, bright yellow spots bordered anteriorly and posteriorly with opaque sepia. Third segment nearly twice as wide posteriorly as basally; within the middle there is a pair of narrowly separated, clear yellow triangles which are indented in the middle of their posterior margins. Thus these spots resemble inverted V-shaped marks in which the clefts have been largely filled by yellow. These spots are broadly banded by opaque sepia which anteriorly extends nearly to the base of the segment. The fourth segment has similar, larger, more elongate, more deeply cleft and a little more widely separated clear yellow spots which are narrowly extended to reach the base of the segment. The medial area, the cleft and a very narrow margin antero-laterally are opaque sepia. The fifth segment has four yellow, wedge-shaped vittae, all about equally separated from one another. The medial pair are slightly longer but do not reach the posterior margin. They are separated by opaque sepia-brown.

Holotype: male. Chanchamayo, Peru, August 16, 1948, 1100 meters, J. Schunke.

Baccha zerene n. sp.

Related to *mexicana* Curran. There is a pair of dull grey vittate marks enclosed in the opaque black triangle of the third and fourth segment. Females with these opaque subtriangular bands wholly black. Length 12.5–16 mm.

Male.—*Head:* face black, diffusely yellowish white along the sides. The cheeks are black, the front shining black with an opaque black triangle above. The preantennal callus is large yellowish brown laterally, black in the middle and black posteriorly. The pile of the face and front is abundant, long and black. The facial pollen is distinctly white to silvery, extending narrowly up along the sides of the front as far as the middle where it ends and re-appears near the upper third of the front only to disappear at the base of the opaque black triangle. The antennae are quite black; only the base of the third segment is narrowly reddish below. The arista is black, a little reddish at the extreme base. The vertex is black, shining behind, but more nearly opaque between the ocelli; the black pile appears to be in a single row. The occiput is black with nearly white pollen with a row of long, scarcely flattened, white hairs in the middle. The upper occipital pile and the hairs next to the eye margin in the middle of the occiput are black. *Thorax:* black with very faint, submedial, reddish sepia, pollinose vittae which do not extend beyond the suture. There is no distinct area of lighter pollen in front of the scutellum. The scutellum is nearly black, but actually is perhaps of a very dark sepia color. The mesonotal pile is abundant, short and black, the scutellar pile similar. The ventral fringe consists of eight or nine pairs of yellow hairs, some of them quite long. Mesonotum with a well developed, pale yellow anterior collar of pile. The squamae and fringe are dark sepia, the halteres reddish sepia. The pleura are shining black, the posterior margin of the mesopleura obscurely-reddish brown.

Pleural pile yellow with a fringe of black hairs along the upper posterior margin of the mesopleura. Pollen whitish. *Legs:* anterior and middle femora very dark reddish-sepia, the middle pair almost black posteriorly, their tibiae nearly black, the tarsi also nearly black. The hind femora and tibiae are entirely black with dense, short black pile throughout. The hind basitarsi are blackish on the basal two-thirds, the remainder of these tarsi nearly white with white pile. *Wings:* deeply tinged with sepia on the entire base to just beyond the anterior cross vein with the exception of the anal cell, which is considerably paler at least on the marginal half. The posterior half and base of the preanal cell is also somewhat paler. Alulae wide, dark brown basally, diffusely merging into the subhyaline border. The dark sepia area of the base of the wing is nowhere sharply marked and grades diffusely off into the pale grey, nearly hyaline portion of the remainder of the wing. The marginal cell and whole of the submarginal cell are distinctly brown, but not quite so dark as the basal part of the wing. The preanal spuria is distinct. The third longitudinal vein is slightly curved backward before the end of the subapical cross vein. *Abdomen:* quite petiolate. The first segment is shining black; the second segment is nearly six times as long as its least width, very little more narrow in the middle than apically and its base and apex of nearly the same width. This segment is light reddish-sepia with, beginning a short distance from the posterior margin, a large, extensive, opaque, nearly black triangle which is quite long and acute and which reaches to within a short distance of the base. The third segment is similarly colored basolaterally, the posterior margin shining blackish, the greater part of this segment occupied by a very large, opaque black triangle which encloses a pair of obscure reddish, vittate streaks. The fourth segment also has a very large but shorter and broader opaque black triangle which like that of the third reaches the base of the segment and encloses a pair of similar though lead-grey vittate spots. The basal corners of this segment are more narrowly light reddish-brown. The fifth segment is shining black with three, short oval, opaque black basal spots. The pile of the abdomen is everywhere black except posteriorly upon the first segment where it is whitish. First segment pile long.

Female.—Face and head similar to the male, the front black, the white linear pollen along the eye margins uninterrupted. The squamae are very pale yellow but the fringe reddish-sepia. The legs are similar to the male, the dorsal pile of the middle tarsi whitish, the anterior tarsal pile black dorsally. The abdomen has the second segment only about two and a half times as long as its least width; it is very little narrowed in the middle. The third segment is as long as its posterior width and the posterior width not quite twice as wide as the basal width. The fourth segment is a little wider than long, the fifth segment nearly twice as wide as its length. Sixth segment almost as wide basally as the length of the segment and considerably narrowed posteriorly with a medial ridge. The seventh segment is laterally flattened. The second and third segments each have a large, central, opaque black triangle. The fourth segment has a large, broad, gently arched, opaque black band reaching nearly to the base of the segment; it is somewhat arched and occupies nearly the whole of the segment. The fifth segment is indistinctly opaque in the middle; the crumpled condition makes it difficult to discover the pattern. The sixth segment is entirely shining black. Pile of abdomen black except for a few white hairs along the sides of the second segment in the middle and anteriorly and posteriorly along the sides of the first segment.

Holotype: male, Chanchamayo, Peru, August 3, 1948; allotype, a female, July 17, 1948, J. Schunke.

A TABULATION OF OHIO BOBWHITE QUAIL FOODS

VINCENT SCHULTZ[1]

The Ohio State University, Columbus, Ohio

Although the bobwhite quail, *Colinus v. virginianus*, has been on the protected list in Ohio since 1912, the time may come when vigorous legislative pressure will change its status from that of a song bird to a game species. Knowledge of the food requirements of a game species is one of the first essentials to the establishment of sound management practices. The almost complete lack of data on the food habits of the bobwhite quail in Ohio has led the writer to present a detailed report, for the records, of the analysis of 70 quail crops. These crops were collected in various Ohio counties while conducting a vitamin A deficiency study on the bobwhite quail during the winter of 1946–47.

Of the two food habit studies known to have been made in Ohio neither one is of any great value due to limited availability and incompleteness. The results of Judd's study in 1890 is limited to 8 specimen cards on file at the Patuxent Research Refuge, Laurel, Maryland. Hick's report (Bullentin Number 105 of The Ohio Division of Conservation and Natural Resources) on the analysis of 68 quail stomachs is of limited value as it is not readily available and the results obtained from birds from various physiographic areas of the state have been combined. It is the writer's opinion that the results should be tabulated on a physiographic bais rather than by using a method of combining the results and considering the final results as indicative of the feeding habits of the quail in Ohio. No method of compiling the results of stomach or crop analysis is entirely free from the danger of misrepresentation of a species' actual food habits. An attempt is made in Tables 1 and 2 to eliminate or reduce to a practical minimum this tendency of misrepresentation. These tables contain the results of the analysis of 70 quail crops. Birds that are trapped by baiting generally have little or no natural food present in their crops; therefore, data from such birds presented on a total volume basis are not comparable with similar data obtained from birds collected by shooting. As data obtained from quail that were shot or trapped was not considered to be comparable, presentation of the findings is in two separate tables. Table 1 contains data obtained from 46 quail collected by shooting from various counties, as follows: Athens (Nov.—1 bird), Cuyahoga (Aug.—1 bird, Jan.—1 bird, Mar.—2 birds), Delaware (Nov.—2 birds), Medina (Jan.—1 bird), Meigs (Dec.—2 birds), Montgomery (Jan.—1 bird), Vinton (Nov.—6 birds, Dec.—17 birds, Jan.—6 birds, Feb.—8 birds), and Williams (Nov.—1 bird). Table 2 contains data obtained from 24 birds trapped by baiting, as follows: Delaware (Dec.—7 birds), Franklin (Oct.—5 birds, Nov.—2 birds, Dec.—1 bird, Feb.—4 birds) and Medina (Feb.—5 birds). Commercial scratch feed and cracked corn were used as bait

[1]The analyses were conducted while on a research fellowship granted by The Ohio Co-operative Wildlife Research Unit: The Ohio State University, The Ohio Division of Conservation and Natural Resources, The Fish and Wildlife Service and The Wildlife Management Institute co-operating. Personal acknowledgments are made to A. C. Martin, R. T. Mitchell, K. A. Mitchell, R. Will and D. L. Leedy.

and as their presence in the crops resulted from unnatural conditions they were not tabulated in Table 2.[2]

TABLE I

CONTENTS OF QUAIL CROPS FROM SHOT SPECIMENS

I. PLANT MATERIAL

Acalypha sp.	Unglac.—D. 1 (1–s)
Acalypha virginica	Glac.—J. 1(2–s); Unglac.—D. 2(17–s)
Actinomeris alternifolius	Unglac.—D. 2(1.5 cc)
Ambrosia artemisiifolia	Glac.—J. 2(.6cc); Unglac.—N. 6(71.0cc), D. 16 (83.8cc), J. 2(7.8cc)
Anagallis arvensis	Unglac.—J. 1(12–s)
Asclepias sp.	Unglac.—N. 1(1–s), D. 4(1.5cc)
Avena sativa	Glac.—A. 1(9.0cc)
Bidens aristosa	Unglac.—N. 1(1–s), D. 2(24–s)
Bromus secalinus	Unglac.—N. 1(.7cc)
Celastrus scandens	Unglac.—D. 2(.2cc)
Cerastium sp.	Unglac.—D. 1(1–s)
Cerastium vulgatum	Glac.—A. 1(7–s)
Compositae	Glac.—J. 1(1–s)
Desmodium sp.	Unglac.—N. 4(8.0cc), D. 4(2.1cc), F. 6(1.0cc)
Digitaria ischaemum	Unglac.—D. 2(4–s)
Euphorbia corollata	Unglac.—N. 1(1–s)
Galium sp. (green vegetative)	Unglac.—D. 2(2.2cc)
Geum sp.	Unglac.—D. 1(2–s)
Glycine max.	Glac.—M. 2(10.0cc)
Impatiens sp.	Unglac.—N. 3(.2cc), D. 7(13.9cc)
Leersia oryzoides	Unglac.—D. 1(.3cc)
Lespedeza sp.	Unglac.—D. 3(9–s)
Lespedeza stipulacea	Unglac.—J. 5(26.9cc), F. 1(.6cc)
Lespedeza striata	Unglac.—F. 1(.2cc)
Oxalis sp.	Glac.—A. 1(2–s), J. 1(1–s); Unglac.—D. 1(1–s)
Oxalis sp. (green vegetative)	Unglac.—F. 1(t)
Panicum capillare	Glac.—N. 2(.2cc); Unglac.—N. 1(1–s), D. 3(1.1cc)
Panicum sp.	Unglac.—N. 4(1.1cc), D. 5(.3cc), F. 2(2–s)
Paspalum laeve	Unglac.—N. 1(6–s), D. 1(3–s)
Paspalum sp.	Unglac.—N. 3(.3cc), D. 1(1–s), J. 1(1–s)
Physalis sp.	Unglac.—N. 1(20–s)
Polygonum aviculare	Glac.—N. 1(1–s)
P. dumetorum	Unglac.—N. 1(.4cc), D. 2(.1cc)
P. hydropiper	Unglac.—D. 1(.5cc)
P. pennsylvanicum	Unglac.—N. 1(1–s), D. 5(8.9cc)
P. persicaria	Glac.—A. 1(6–s); Unglac.—D. 3(.4cc)
P. punctata	Unglac.—N. 1(3–s)
Portulaca oleracea	Glac.—A. 1(30–s)
Potentilla sp.	Unglac.—D. 1(1–s)
Prunus serotina	Unglac.—D. 1(4.0cc)
Quercus sp.	Unglac.—D. 3(6.4cc), F. 2(15.0cc)

[2]Glac. and unglac. refer to quail collected in glaciated and unglaciated Ohio, respectively. Letters A, O, D, J, F and M refer to the months of August, October, December, January, February and March, respectively. The number preceding the brackets refers to the number of specimens examined in which the particular material was found. Symbols in brackets refer to the total amount in the crops for that particular month, either as a number of seeds (–s), trace (t), or number of cc. (–cc.). The number within the brackets that pertains to animal material refers to the number of different individuals. All animal material except where otherwise indicated refers to adult forms.

Example: Glac.–D. 2(4–s).

Two specimens collected in glaciated Ohio in December contained a total of four seeds.

Scientific names from:

Britton, W. E. 1920. Check list of the insects of Connecticut. State Geological and Natural History Survey, Public Document No. 47.

Schaffner, J. H. 1914. Catalog of Ohio vascular plants. Ohio Biological Survey, Bulletin Number 2.

TABLE 1—*Continued*

Rhus copallina	Unglac.—D. 4(2.9cc), F. 1(3.5cc)
Robinia pseudo-acacia	Unglac.—D. 1(3–s)
Rubus sp.	Glac.—A. 1(3–s)
Rumex acetosella	Glac.—J. 1(.7cc), M. 1(.1cc); Unglac.—N. 1(7–s), D. 1(2–s)
Rumex acetosella (green vegetative)	Unglac.—D. 3(.1cc), F. 1(t)
Sassafras sassafras	Unglac.—D. 4(.7cc)
Setaria glauca	Glac.—J. 2(.4cc); Unglac.—D. 1(3–s), J. 2(1.3cc)
Sida spinosa	Unglac.—D. 1(1–s)
Trifolium pratense	Unglac.—D. 1(10–s)
Trifolium repens (green vegetative)	Unglac.—N. 3(t), D. 2(t), J. 2(t), F. 1(.1cc)
Trifolium sp.	Unglac. —N. 1(1–s), D. 1(1–s)
Triticum aestivum	Unglac.—N. 1(2–s), D. 1(1–s), J. 1(4–s)
Vitis sp.	Unglac.—N. 1(1.5cc), D. 5(17.2cc)
Zea Mays	Glac.—N. 2(1.0cc); Unglac.—N. 2(16.1cc), D. 6 (6.6cc)
Zea mays (sweet)	Glac.—J. 1(6.5cc)
Unknown:	
Fruit skin	Unglac.—J. 1(t)
Tuber-like root stocks of grass (green)	Unglac.—D. 1(.1cc)
Twig	Unglac.—D. 1(.2cc)
Green vegetative material	Glac.—A. 1(t); Unglac.—N. 2(t), D. 4(.1cc), F. 3(t)

II. Animal Material

Acrididae	Unglac.—N. 3(4)
Agallia sp.	Glac.—J. 1(1)
Aphididae	Unglac.—N. 1(1), J. 1(t of 8)
Arachnida (spider)	Unglac.—D. 2(4)
Carabidae	Unglac.—N. 1(1)
Carabidae larva	Unglac.—N. 4(14)
Cercopidae	Glac.—A. 1(1); Unglac.—N. 1(1), D. 1(2)
Chalepus dorsalis	Unglac.—D. 2(4)
Chrysomelidae	Glac.—A. 1(2); Unglac.—N. 1(1), D. 1(3)
Cicadellidae	Unglac.—N. 1(1), D. 1(1)
Elachistidae	Unglac.—N. 1(1)
Coleoptera larva	Unglac.—N. 2(2)
Corsicus	Unglac.—N. 1(1)
Curculionidae	Unglac.—N. 1(1)
Elateridae	Glac.—A. 1(1)
Formicidae	Unglac.—N. 1(2)
Gastropoda (slug)	Unglac.—N. 1(2)
Gastropoda (snail)	Unglac.—N. 1(2), D. 1(2)
Hymenoptera	Unglac.—N. 1(1)
Lepidoptera larva	Unglac.—N. 1(1)
Lygus pratensis	Glac.—A. 1(1)
Staphylinidae	Unglac.—N. 1(1)
Sawfly larva	Glac. A. 1(15)
Unknown	Unglac.—N. 1(1)

III. Miscellaneous

Debris	Unglac.—N. 2(.6cc), D. 4(2.4cc), J. 1(.1cc)
Grit	Glac.—J. 1(t); Unglac.—N. 1(t), D. 2(.5cc), F. 1(t)

TABLE II

Contents of Quail Crops from Trapped Specimens

I. Plant Material

Ambrosia artemisiifolia	Glac.—F. 1(1–2)
Bidens sp.	Glac.—D. 2(2–s)
Cryptotaenia canadensis	Glac.—F. 3(.2cc)
Cyperus sp. (green vegetative)	Glac.—D. 1(t)
Desmodium sp.	Glac.—D. 5(.6cc)
Digitaria sanguinalis	Glac.—D. 1(1–s)
Festuca nutans	Glac.—F. 1(3–s)

TABLE II—*Continued*

Fraxinus sp.	Glac.—D. 1(2–s)
Geum sp.	Glac.—F. 1(3–s)
Maclura pomifera	Glac.—D. 1(1–s)
Oxalis sp.	Glac.—O. 1(1–s)
Panicum capillare	Glac.—D. 1(3–s), F. 1(1–s)
Polygonum convolvulus	Glac.—N. 1(1–s)
Polygonum persicaria	Glac.—F. 2(2–s)
Potentilla sp. (green vegetative)	Glac.—F. 1(t)
Rumex acetosella (green vegetative)	Glac.—N. 1(t)
Solanum nigrum	Glac.—O. 1(10–s)
Setaria glauca	Glac.—F. 3(.2cc)
Setaria viridis	Glac.—O. 1(1–s)
Trifolium repens (green vegetative)	Glac.—D. 1(t)
Viola sp.	Glac.—O. 5(.7cc)
Vitis sp.	Glac.—O. 1(3–s)
Unknown:	
Green vegetative material	Glac.—O. 1(t), N. 1(t), F. 3(t)
II. Animal Matter	
Acrididae	Glac.—O. 1(3), N. 1(1)
Arachnida (spider)	Glac.—F. 1(t–1)
Carabidae	Glac.—D. 1(3)
Gastropoda (snail)	Glac.—O. 1(2)
Hemiptera nymph (?)	Glac.—O. 1(1)
Ichneumonidae	Glac.—F. 1(t–1)
III. Miscellaneous	
Grit	Glac.—D. 1(t)

INDEX TO VOLUME XLIX

Allegheny Formation of Ohio, 1.
Allen, Rolland Craten, obituary, 166.
Altick, Arthur Riggs, obituary, 167.
Anderson, Bertil G., 242.
Annual Report, Ohio Academy of Science, 160.
Anthropology and Human Growth, 89.
Ape or Man, 129.
Australopithecus africanus, 129.
Avifaunas of Ohio and Denmark, 15.

Baccha halcyone n. sp., 244.
Baccha zabulon n. sp., 244.
Baccha zerene n. sp., 245.
Barbour, George B., 129.
Black, Arthur H., 92.
Bowman, H. H. M., 230.
Bradytus celianus n. sp., 208.
Bradytus novellus n. sp., 207.
Bradytus vegasensis n. sp., 207.
Bridge between East and West, 41.
Brown, H. D., 97.
Brundage, Donald K., 92.
Bufo americanus, Redleg of, 70.

Caley, Earle R., 73.
Choanotaenia sciuricola n. sp., 146.
Chemistry of Thionyldiacetic Acid, 149.
Clarke, Helen, 32.
Climatic Study, Lexington, Ky., 221.
Coleoptera, new species, 102, 199, 205.
Colinus population fluctuation, 85.
Colinus v. virginianus in Ohio, 247.
Cooke, Virgil, 146.
Cottingham, Kenneth, 34.
Craspedacusta sowerbii from Ohio and Pennsylvania, 235.
Culler, Dorothy, 97.
Czecho-Slavokia, 41.

Davidson, Ralph H., 127.
Davis, Charles W., 235.
DeLong, Dwight M., 83, 115, 173.
Denmark, Avifaunas, 15.
Dexter, Ralph W., 235.
Dockeray, Floyd C., memorial, 167.
Dodson, Vance H., 149.
Draeculacephala californica n. sp., 127.
Dusi, Julian L., 70.

Earthworm, locomotion, 109.
Ebaugh, William Clarence, memorial, 167.
Eburia stroheckeri n. sp., 104.
Erythroneura dimidiata n. sp., 122.
Erythroneura direpta n. sp., 125.
Erythroneura flexibilis n. sp., 122.
Erythroneura hymettana n. sp., 124.
Erythroneura luculenta n. sp., 124.
Erythroneura malaca n. sp., 126.
Erythroneura prolixa n. sp., 126.
Erythroneura wvaldeana n. sp., 125.
Esterification of acetic acid, 92.
Evolution, 169.

Fichter, George S., 201.
Fossiliferous member in Allegheny Formation, 1.
Frazier, Norman W., 127.
Fungi, effect on tomato juice, 97.

Geldreich, Jr., Edwin E., 191.
Genetics, human, 32.
Geology in Ohio Place-Names, 34.
Gold content determination, 73.
Gold, Specific Gravity Method, 73.
Gray, William D., 105.

Harwood, Paul D., 146.
Helminths from Fox Squirrel, 146.
Hershberger, Ruth V., 173.
Hull, F. M., 244.
Human Ancestry from South Africa, 129.
Human inheritance, 32.
Hutter, Harry K., 221.

Isohydnocera chiricahuana n. sp., 200.

Japan, 209.
Jellyfish, Fresh-Water, records for Ohio and Pennsylvania, 235.

Knull, Dorothy J., 119.
Knull, Josef N., 102, 199.

Lacon floridanus n. sp., 102.
Leafhoppers, n. sp., 115, 119, 173.
Lexington, Kentucky, 221.
Liverworts, Culturing Media, 191.
Ludmer, Henry, 41, 209.

Mahr, August 3., 45.
Manometric pipetting device, 242.
Masters, Charles Otto, 12, 188.
McAtee, W. L., 169.
Merrill, William M., 1.
Metasequoia, discovery of, 71.
Miller, John A., 109.
Moore, Carl V., 32.
Morphology of Spironema, 230.
Moseley, Edwin Lincoln, obituary, 168.
Mosquito Population, 12.
Mosquitoes, proportions of male and female, 188.
Myxomycete, laboratory cultivation, 105.

Natural History of Ohio, early, 45.
Necrophagy, 201.
Necrophily vs. Necrophagy, 201.
Numerical Abundance as criterion for successful species, 169.
Nutrient media for Liverworts, 191.

Oddy, Harold G., 149.
Ohio Academy of Science, 160.
Ohio Avifauna, 15.
Ohio Geology, 1.
Ohio Geology in Place-Names, 34.
Ohio Mosquito Population, 12.
Ohio Natural History, early, 45.
Oriental Fruit Moth, 154.

Parasites of Oriental Fruit Moth, 154.
Physarella oblonga, cultivation of, 105.
Physarum didermoides, cultivation of, 105.
Phyllobaenus stupka n. sp., 199.
Phyllobaenus varipunctatus n. sp., 199.
Pipetting device, 242.
Pregnancy, complications in, 195.
Pseudomonas hydrophilia, 70.

Quail Foods in Ohio, 247.
Quail population fluctuations, 85.

Redleg in Toads, 70.
Reynolds, Earle L., 89.
Ross, Herbert H., 115.

Scaphoideus, new name for, 83.
Schultz, Vincent, 85, 247.
Sciurus niger infested with Helminths, 146.
Sickle Cells and M-N Blood Types, 32.
Silbernagel, Wayne M., 195.
Snyder, Laurence H., 32.
Spathanus acutus n. sp., 121.
Spathanus aureus n. sp., 121.
Spathanus excavatus n. sp., 122.
Spironema fragrans, 230.
Stehr, William C., 205.
Stirellus subnubilus n. sp., 119.
Stragania hualpaiana n. sp., 119.
Sturgeon, Myron T., 1.
Surrarrer, Thomas C., 235.

Texananus species of N. A., 173.
Thionyldiacetic Acid, 149.

Ting, Han-Po, 109.
Toads, Redleg of, 70.
Tomato juice, flavor and color, 97.
Typhlocyba escana n. sp., 118.
Typhlocyba serrula n. sp., 118.
Typhlocyba sollisa n. sp., 116.
Typhlocyba tortosa n. sp., 115.
Typhlocyba troza n. sp., 117.

Van Sickle, Guy E., memorial, 168.
Vapor Phase Esterification, 92.

Weaver, C. R., 154.
Westerskov, Kaj, 15.
Wildlife Facts, 159.
Wilson, Mildred, 97.